The Mining Journal

Mineral Processing Supplement

Vol. 254 No. 6501 (Supt). LONDON, MARCH 25, 1960

CONTENTS

The Purpose of this Supplement

This Supplement is devoted:

(1) to an appreciation of the papers before the International Mineral Processing Congress to be held at Church House, London, from April 6-9, by the Institution of Mining and Metallurgy.

(2) to a survey of the full range of plant, equipment and know-how available to the mill designer and mill manager from British manufacturers. Some of these manufacturers will be showing at the Mineral Processing Exhibition, to be held at Church House concurrently with the Congress under the auspices of the British Chemical Plant Manufacturers' Association.

This Supplement has been prepared for the benefit of overseas members of the Congress and visitors to the Exhibition, no less than for our own readers around the world. It is our hope that it will reach the majority of members at least a week before the opening of the Congress. The Supplement is only lightly attached to the main body of *The Mining Journal* from which it can readily be separated for convenience in carrying.

At the Congress some fifty pre-printed papers are scheduled for discussion over ten sessions lasting in all some twelve hours. The papers at each session will be taken as read, but will be briefly introduced by a rapporteur. Consequently, it is clearly important that the points of major interest thrown up by the papers should be identified and considered by members in advance, so as to ensure the maximum benefit from so intensive a period of discussion.

It is with this objective in view that we publish in this Supplement an appreciation of the Congress papers, session by session. Although this only constitutes one man's view of some at least of the points which seem most relevant for discussion, we feel that this pre-digestion of the numerous papers submitted may be of assistance to those members who may not have had time prior to the discussion to become fully acquainted with the contents of all the papers.

An official catalogue of the Mineral Processing Exhibition, which will be available to Congress members, deals fully with the range of plant and equipment available from exhibitors. Limitations of space have, however, restricted the number of manufacturers whom it has been possible to accommodate at the Exhibition.

We, therefore, believe that the inclusion in this Supplement of a comprehensive Buyers' Guide to the products, which British manufacturers are in a position to supply to the mineral processing industry, together with editorial notes on many of them, will provide invaluable supplementary information for Congress members and others from overseas who will be visiting the Exhibition.

Staff on *The Mining Journal's* Exhibition stand (No. 30) will be available to assist visitors who require further information.

HIGHLIGHTS FROM THE CONGRESS PAPERS

In this article we have invited a leading authority on mineral processing to assess what appear to him to be the points of major interest arising from the papers to be discussed at the International Mineral Processing Congress. Readers will appreciate that the resultant observations are essentially one man's view of the relative importance of the vast amount of material before the Congress and, with some fifty papers to assess, that these observations must inevitably be selective. We nevertheless have pleasure in presenting them in the belief that the pre-digestion which they represent will be of assistance to those who may not have had time to become fully acquainted with the contents of all the papers prior to the opening of the Congress

THIS article is divided into sections corresponding to the various Congress discussion sessions into which the papers have been grouped.

Group I. COMMINUTION

The contributions indicate that autogenous grinding is in the forefront at the present but there are two approaches towards achieving more efficient comminution, namely by increasing the work done by attrition or by making use of greater impact energy.

Hukki reports further extensive experimental work (paper No. 1) and indicates the parameters influencing the throughput and energy used. The use of a unit, "the base mill" is suggested so that any grinding operation under varying conditions of size and speed can be compared.

Following on studies at super-critical speed, a design is put forward, making greater use of attrition reduction by the muller action of the tumbling material. This is brought about by a series of blades which 'brakes' the sliding material so that the necessary action is obtained at about 100 per cent of critical speed compared with possibly 200 per cent in a simple revolving cylinder. Since no media is added and the shell is designed to carry an autogenous lining, wear may be low. It remains to be seen whether the wear on such a braking mechanism is satisfactory.

Such mills, like these run at a high super-critical speed, have no lifters and carry a small volumetric load. Although capacity is increased the energy needed for comminution is slightly lower than in a conventional mill. In paper No. 5, Westerlund describes a vertical mill, in which an intense attrition zone is produced in the annular space between two counter rotating cylinders.

As in any high speed attrition grinding, wear on media seems to be high but is no objection if the operation is autogenous.

This mill is said to show promise as being efficient and to have a capacity of 6 to 8 times that of a conventional mill, and certainly is worth further research since the capital outlay may possibly be a favourable factor.

The Aerofall mill is also autogenous, of course, but appears to rely on the effect of sharp impact rather than attrition (paper No. 2, Weston). A great deal of work has gone into the development of mills of this kind and indeed without much reward for some years. At last the work seems to be bearing fruit, and has had some signal successes.

Comminution is due to *sudden* compression and subsequent release so that breakage occurs more often at crystal boundaries. In this way liberation takes place at an appreciably greater overall mesh of grind than is possible in a conventional ball or rod mill.

Whether this principle or attrition will prove the most efficient means of reduction remains to be seen, but Fagerberg and Ornstein (No. 3) indicate that the Aerofall mill does break along mineral boundaries and on the magnetite ores tested, provides better liberation than a rod mill. On the other hand, it does appear that there may be a limitation to the coarseness of grind which is possible.

It must be remembered in assessing the merits of this type of grinding or attrition milling, that the ground products probably have a different size distribution, the Aerofall mill tending to break along mineral boundaries and a mill using forced attrition yielding a greater specific surface for the same upper size limit.

It seems likely, therefore, that choice might be controlled by the subsequent treatment.

Another point to be born in mind is that comparisons made to date are based on a dry feed, but if drying was necessary, this might well prove to be the decisive factor.

A very interesting analysis of laboratory grinding technique and the correlation between laboratory batch operation and plant practice is offered by Armstrong (paper No.).

Group II. CLASSIFICATION AND THICKENING

As might be expected a great deal of attention has been given to the problem of cyclone design and the complex hydromechanics involved.

Bradley (paper No. 7) discusses the influence of some of the variables in cyclone design and shows how units may be chosen for a particular job and the performance predicted with reasonable accuracy. Whereas the empirical relationships given are likely to be valuable, and permit specification of a cyclone thickener plant with a particular design, a number of variables have not been considered.

It would, however, appear that there is an optimum length of vortex finder for each set of conditions so that in instances where variations are likely to occur some means of altering the vortex finder length might be justified.

Peachley (paper No. 8) on the other hand, indicates that the quantity of water reporting in the overflow of a large diameter cyclone is a linear function of the quantity of water in the feed and is independent of the actual tonnage being handled.

In the arrangement with no true vortex finder, one is lead to wonder to what extent the mechanics are changed and whether gravity has not appreciable influence on such large low pressure cyclones.

Eight years ago or more attempts were made to use water injection for displacing entrained slime in a cyclone underflow, but indifferent results were reported and the matter has since received little attention. Kelsall and Holmes, however, have re-investigated this matter and show that efficient displacement can be obtained with a minimum amount of injected water. Little or no change in the pulp density of either the overflow or underflow is claimed so that improvement in the efficiency of closed circuit grinding might result from its adoption.

Obviously there is a great deal yet to be learnt about hydrocyclones and some evidence appears conflicting so that fruitful discussion should result.

Most thickener designs are based on the interpretation of empirical settling data with reasonable accuracy, but Gaudin and Fuerstenau (paper No. 6) produce evidence to show that the process of sedimentation of flocs is probably bimodal. It is suggested that in the early stages the flocs settle so that the water rises between them, but later, when they begin to consolidate, any water actually filters through the intertices in the flocs and actual settling measurements do in fact confirm the theoretical behaviour based on these two mechanisms.

The measurement of densities at various points during sedimentation also indicates that the descent of the top of the settling solids is not an accurate indication of conditions, and, in fact, the rate of descent varies with the depth of the pulp in the settling vessel. From this it would seem that settling tests based on the descent of the "mud-line" may give data on the thickener capacity relative to the overflow, but it cannot be assumed that the increase in density of the underflow is related to this "mud-line." This, however, is probably usually taken care of by measuring the settling rate at different pulp densities and determining the "final" density, when suitable allowances can be made.

One paper in the group (No. 10, by Ferrara) might possibly be better considered under gravity concentration since it describes what appears to be a process more nearly related to separation in a flowing film, being one in which the mixed minerals in a pulp are allowed to flow through a rotating tube. A great deal of work must obviously be done but the principle deserves further attention since it is claimed that long range feeds can be effectively treated. Should it be found possible to treat particles in the order of 10 - 30 μ the application of centrifugal force would greatly facilitate separation. A satisfactory means of removing the higher specific gravity material must be

developed, however—an operation which has been the stumbling block in the development of other centrifugal devices.

Group III and IV. FLOTATION RESEARCH AND PRACTICE

These represent perhaps two of the longest sessions. Eigeles and Volova (paper No. 14) report a kinetic method to determine the minimum time required to establish adhesion in flotation, and it is suggested that a straight line relationship exists between the log of the minimum contact time and the reciprocal temperature.

Of particular interest is the statement that many minerals will adhere to the bubble provided sufficient induction time is allowed, although normally the contact which is permitted in a flotation cell does not allow time for such adhesion.

Other factors such as the mode of grinding, the temperature and collector concentration also materially affect the induction time according to the authors. Wada (paper No. 15) reports work on the relationishp between the adsorption energy and the wettability of solid surfaces in an aqueous solution of surface active substances.

Glembotsky on Selective Flotation

A paper of particular interest and possible potential value in selective flotation is that by Glembotsky (paper No. 12) dealing with the stability of collector coatings.

Desorption of reagents in a bulk concentrate so that selection can be made by retreatment is practised but any degree of selective desorption or, indeed, any method whereby, filtration and/or washing could be avoided would be obviously of considerable commercial importance.

It would seem that possibly ultrasonic vibrations may be the solution, since xanthate adsorption layers are destroyed after a very short treatment time and the residual pulp contains no free xanthate, according to the author. Furthermore, the action appears to bè selective. Other methods (such as heating and mechanical abrasion) have also been investigated, and it is claimed that the passage of an electric current through a bed of mineral is actually more effective than the application of heat alone. Suggestions of this type are worth investigating, but some desorption techniques have proved to be rather ineffective in practice and further contributions may furnish additional evidence.

Bogdanova *et al* in paper No. 11, discuss flotation kinetics and explain a number of observed facts in connection with activation and depression, such as the difference in the activation of sphalerite by various copper minerals, and greater efficiency of the zinc-cyanide complex as a depressing agent in the presence of copper ions.

In paper No. 17, Leja and Poling discuss the problem of interpreting contact angle measurements and show why the conventional measurement of the static contact angle is not necessarily a measure of the threshold hydrophobicity of the solid surface.

Plaskin reviews a great deal of the work done by himself and his co-workers but the most interesting features are his observations of the fact that surfaces can possess both anodic and cathodic characteristics, and that dissolved oxygen in water has a profound affect, not only on sulphide minerals but also on certain non-sulphide mineral.

The effect of oxygen can be one of considerable practical importance since it is claimed that rutile, ilmenite and zircon, for example, can be floated in an oxygenated pulp whereas the two former can be subsequently depressed by passing nitrogen through the pulp.

The rôle of gases in flotation is also discussed by Klassen (paper No. 16). Again there are possible applications, since it is pointed out that particles in the size range 10 to 5 microns float more readily when minute bubbles are precipitated, such as in a vacuum process. This may be due to other factors than opportunity of contact, such as lack of sphericity and the oscillation of larger bubbles, and indeed the reverse has been observed.

It is also suggested that large particles are floated more readily by "gas precipitation." This appears to be true and the air-lift principle is, in fact, being tested in this connection.

Blaskett (paper No. 19) provides some interesting data on the depression of gangue minerals when floating galena and suggests that certain of these minerals may develop hydrophobic coatings in the presence of sulphydric collectors Similarly Rey and Formanek (paper No. 18, Group III) indicate that limestone possesses some natural floatability but appears to lose this property when the ore is ground in an iron mill. This property is seen in the presence of a frother only and it has been observed with other minerals but in addition it can be shown that xanthate is sorbed on such minerals as barite under some conditions so that there are probably a number of factors involved.

It is also suggested that the presence of iron derived from grinding has a marked effect on the flotation of both galena and sphalerite and that lead minerals activate sphalerite to some extent. Since, however, there are many factors which can affect the selectivity a number of possible explanations could be given for the effects observed; this subject could give rise to a lengthy discussion.

Flotation of ilmenite is discussed in two papers (No. 20 by Edsmo and Mellgren, and No. 21 by Runolinna, Rinne and Kurronen). Whilst in both cases fatty acid emulsions are employed, the fuel oil addition in one instance is said to be a froth modifier only but in the other it is used to produce a degree of agglomeration. Indeed, it is also suggested that the fuel oil actually promotes the removal of the collector from the silicate minerals by the detergent action explained by Leja.

Since there are other similar phenomena recorded and there is the interesting parallel of the process used on Three Kids manganese ore, these papers deserve a close study and further discussion should be valuable.

Paper No. 22 by Bogdanova *et el* should be considered at the same time because it concerns the flotation of brown iron and manganese ores, where both kerosene and oxidised kerosene is employed.

The only paper (No. 23) at the Congress dealing with cationic flotation is a description by Wilson of the production of felspathic sand and a muscovite rich product from granite on the Isle of Man, which is interesting for two reasons.

Firstly, it is the first mica flotation plant in the U.K. to be described and secondly, because it employs an unique flowsheet involving the use of table–flotation, as well as froth flotation, in order to eliminate the larger flake mica.

Group V. GRAVITY AND DENSE MEDIA SEPARATION

The papers can be divided roughly into three sections, fundamental studies, dense media separation and operational studies.

In the first section, Kirchberg and Berger (paper No. 25), deal with the behaviour of a bed of particles when oscillated such as takes place between the riffles on a table.

Results appear to indicate that small heavy particles pass to the bottom readily but large heavy ones have only a slight chance of reaching and staying in the bottom layer. This observation should be studied simultaneously with that made by Harris (I.M.M. Bull. No. 637), on the failure of *middle* size particles to penetrate a jig bed and obviously with some factor not taken into account, a great deal more study is necessary.

The work does show that there is an optimum depth of bed so that any attempt to increase throughput by increasing the bed depth is not possible, whilst eddies close to riffles interfere with statification.

This indicates that a closer study of riffle profile is desirable but many other factors are also involved in table concentration such as initial feed velocity and statification due to the flowing film at the surface of the bed.

Motion of Particles in Jigging

A paper by Lill, the late H. G. Smith (paper No. 24), deals with the motion of particles in jigging and supports the findings of Kirchberg that the bed dilates from the bottom. Of particular interest is the way in which the resistance to particles, larger than the bed size, is related to the shape of the particles forming the bed.

Unfortunately the research has not been carried into the size range where Harris claims the middle size particles concentrate less readily.

In the second section four papers deal with various aspects of D.M.S., including the efficiency of the method in diamond concentration (paper No. 26, by Nesbit and Wevind), the characteristic of the cyclone when used as a separator by Cohen and Isherwood (paper No. 28), magnetic control of cone underflow by Moiset and Dartois (paper No. 27), and the use of T.B.E. by Baniel and Mitzmager (paper No. 30).

D.M.S. in Cyclones

The paper on the cyclone is also worth studying from the point of view of its operation in general and not necessarily in connection with Dense Media. Since elevators or air-lifts tend to disturb separation in a conical separatory vessel the magnetic apparatus described in paper No. 27, is interesting since it controls the underflow discharge by completely if partially plugging the apex orifice by the application of a magnetic field and can be made to permit the passage of non-magnetic material.

The paper on Tetrabromoethane as a medium is a welcome addition since it is the first to be published (apart from trade notices). Processes depending on the use of a heavy liquid have long been utilised in the laboratory and some years ago, Du Pont undertook a considerable amount of research with halogenated hydrocarbons with reference to coal cleaning but the difficulties presented by the cost of the medium and finding effective means of recovering it, made the process uneconomic. (Cont. on p. 5.)

In recent years the development of a process to produce T.B.E. from the Dead Sea brine has made it possible to achieve production at a reasonable price and a great deal of research has been put into the problem of its use and recovery. With a density of 2.96, T.B.E. is sufficiently dense for most separations and can be diluted with naphtha if desired.

Paper No. 29, by Chaston deals with the treatment of Malayan tin alluvials and contains a great deal which might be better considered in Group VIII. although it is really restricted to the first stages in the dressing operation, using jigs. A great deal of work has been done on the problem of fine cassiterite recovery involving desliming in cyclones and there is no doubt that this is an essential step ahead of concentration since "slime" interferes with jig operation, contaminating the dredge paddock so that operation becomes progressively worse, consequently good desliming is becoming increasingly employed on dredges, a fact long recognised as essential in the treatment of lode ores.

The recovery of tin in the middle size range previously brought forward by Harris (I.M.M. Bull. 637), is also discussed but some of the screening operations described are not without their disadvantages.

Group VI. MAGNETIC AND ELECTRICAL SEPARATION: SORTING

Discussions of both high and low intensity magnetic separation are included together with a review of the practice on iron ore treatment by DeVaney (paper No. 31).

Although the bulk of magnetite ores are treated by wet magnetic reparation, the developments in dry autogeneous grinding have brought dry separation into the picture again and factors affecting the operation of the Mortsell-Sala separator are discussed by Kilstedt and Skold (paper No. 32).

As this machine utilised centrifugal force in opposition to the magnetic attraction to separate the non-magnetic material, speed determines the efficiency and is related to the particle size, but very good separation is reported provided the particle size is not too small. Wet treatment appears to be superior when dealing with material of 20 microns and finer, since at this size non-magnetic gangue tends to stick to the magnetite.

It must also be remembered that for efficient dry separation, the feed should carry very little moisture (Kilstedt places the figure at less than ½ per cent), and the range of particle size influences the separation.

Both electrostatic separation and high intensity magnetic separation can also be employed on hematite ores as DeVaney points out but there are many factors to be considered and the subject could well promote lively discussion.

Problems of high intensity magnetic separation, lead to papers No. 34 and 35, each of which describes a novel design for wet operation. Jones (paper 34), describes one type and offers a most interesting discussion on the fundamental principles involved whilst Stone reports the results of a comprehensive series of investigations in Canada, indicating that effective reparation is made in some cases on very fine material using this separator.

In some cases a separation has been obtained on minerals which are normally considered to be unsuitable for magnetic separation and a wide range of sizes in the feed is said to be acceptable.

The Forrer machine (paper No. 35), consists of a somewhat similar high intensity magnetic field but instead of a regulated intermittent action, the separation is achieved by using a magnetic corridor to retain para magnetic particles whilst the diamagnetic particles are forced aside by means of a lateral water flow or by a centrifuging effect. Unfortunately there seems to be no "yardstick" available at present by which to compare these two separators.

The papers on electrostatic methods are also particularly interesting. Barthelemy and Mora (paper 36), give what is probably the first comprehensive theoretical treatment on the mechanics of the high tension roll separators. Although the effect of particle size on the trajectory is mentioned, more could be made of its influence when minerals having small differences in conductivity are to be separated as it has a marked effect and in some instances truly electrostatic separation between plates yields better results. (Paper No. 37 by Kakovsky and Revnivtzev also present research on an aspect about which little has been published, namely the effect of surface conditioning. This is only really effective with minerals of low conductivity, when the surface changes are large in relation to the bulk conductivity but there is considerable scope in this field. Such changes as occur appear to be often due to the water avidity or otherwise of the sorbed film and consequently is dependent on the humidity of the surrounding air.

In this group have also been included three other papers one dealing with further research on an optical sorting method with special reference to diamond separation (paper No. 38 by Linari-Linholm), and the other two concerning the use of the fluidised bed roasting process ahead of magnetic separation (paper No. 39 by Hellmund), and magnetising reduction in a recuperative furnace respectively (paper No. 33 by Eketorp).

Group VII. CHEMICAL PROCESSING

As might be expected reviews of recent development in uranium ore treatment (papers 43 and 44) are included and Bodu describes a procedure involving the precipitation of uranium with lime prior to redisolving and using solvent extraction.

One of the most interesting papers, however, is probably that by Forward and other (No. 40), describing a technique for producing high purity lead by amine leaching. The beauty of this process is that all operations, except the final reduction to metal, can take place at room temperature and no other metals are precipitated from the solution by CO_2. Starting with lead sulphide ore, acid pressure oxidation yields lead sulphate and PbO and leaching with an aqueous solution of alkylene amines dissolves the lead (as well as some other metals), which can be precipitated as a pure carbonate so that high purity silver free lead results. Such a process, if developed commercially, obviously has distinct potentialities.

The account of pressure alkaline leaching of tungsten minerals by Maslenitsky and Perlov (paper 41), is also a useful contribution in a rather limited field since it deals with the application to Wolframite as well as Scheelite ores.

The fourth paper in this group deals with pressure leaching of silicate minerals and the discussion may have some bearing on the flotation of these minerals.

Group VIII. PROCESS STUDY

Three papers only have been included in this group which cover the treatment of widely different ores, namely tin, manganese and apatite. Strictly speaking paper No. 46 by Michell only deals with one aspect of tin concentration, namely the application of flotation for the removal of sulphide and sulpharsenide minerals from a gravity concentrate. The special conditions prevailing and the factors which influence the efficiency of the operation in froth flotation are discussed as well as the employment of table flotation for the treatment of material too coarse for efficient froth flotation. Of particular interest are the observations on slime coating and the use of auxiliary collectors.

The paper by Fleming and Robinson (No. 47), is an excellent illustration of the integration of fundamental research, laboratory testing and pilot plant operation leading to the development of a workable flowsheet.

Much of that covered in all the papers of this group could be also discussed with advantage under some of the other groups, for example, much of papers 46 and 47 deal with flotation. Likewise paper No. 23 could easily be considered under Group VIII. But such overlap is inevitable and it is to be hoped that the discussion will be sufficiently wide to include the funamental features of the unit processes involved as well as broader aspects of application.

Group IX. CONTROL AND TESTING

Again there is rather a wide diversification of subject matter but all is pertinent to the control of mineral processing operations.

The various ways in which automatic control can be applied in a plant is dealt with in one paper and although of necessity is only an outline of what is possible, it provides much food for thought. Obviously the degree of automation is closely tied with the types of process being used and with economics but there is room for much more use of such controls and recording devices in many plants. Consequently this paper should promote a valuable discussion and, it is to be hoped, contributions indicating what has been done in different fields.

Statistical analysis is being used to an increasing extent in many fields and application to mineral processing problems and interpretation of investigations is a welcome addition.

Raffinot (paper 50) reports a study of variance in flotation-testing and confirms some of the work by Nixon and Moir, but, in addition, indicates modifications to a laboratory flotation cell which have been made to reduce the variation in results. Some of these modifications have received attention previously but there is no doubt that any work designed to produce more nearly reproducable results merits serious consideration.

Another aspect of the same problem is discussed by Andrews (paper 51) whilst Digre has re-examined the problem of assessing any concentrating operation which takes into account both concentrate grade and recovery in relation to the grade of feed. As a result he shows the results to be characterized by a single parameter provided the assumptions made in deriving this parameter are applicable to the problem.

Some laboratory-techniques which can be used for separating identifying mineral grains described by Muller (No. 52).

Notes on Mineral Processing Plant and Equipment.

Elsewhere in this issue (page 28) will be found a comprehensive Buyers' Guide followed by a list of the names and addresses of manufacturers whose names appear in the Guide. The Buyers' Guide itself is, on the basis of the information at our disposal, a comprehensive reference to all British manufacturers of plant and equipment for mineral processing. In the notes beginning on this page we have sought to highlight some of the more interesting items of plant and equipment of British manufacturers which are available to the mill designer and mill manager. It will be apparent that these notes, classified in the same framework as that adopted for the Buyers' Guide, are no more than a selection from the wide range of products available. Moreover, there will be cases where the product described may as yet be little known to the metal mining industry, although in such cases it may already be well established in some related technological stage, such for example, as coal preparation

CLASSIFYING AND THICKENING

Dorr-Oliver Co. Ltd.

DorrClones which are now widely used for classifying, desliming and sludge thickening. Other classification equipment includes rake classifiers, sizers, hydro-separators, etc.

International Combustion (Export) Ltd.

The Hardinge thickener. Well established and proved, in operation all over world on various pulps and slurries.

Mechandling Ltd.

"Geco" centre shaft thickener, for the separation of solids from liquid, i.e. where thickening of pulp prior to flotation is required; thickening of concentrates prior to filtering; reclaiming of water for re-circulation; thickening of tailings before disposal to waste; thickening of products in chemical processing. On market 30 years and of U.K. design and manufacture, unit is available in 6 months at prices varying with dia. of tank. Operates at N.C.B. washery plants and at St. John d'El Rey.

Neldco Processes Ltd.

Krebs cyclone. Has long sweep involuted feed entry to give greatly increased capacity. Many patented features and available 3 in. dia. upwards. On market since 1950 it is at present manufactured in U.S. only, although other arrangements are being made. The Krebs cyclone is available for immediate delivery.

Hundreds of installations exist, including U.S. Steel Corp. and Homestake Mining Co. Spares and servicing facilities exist in most countries and training of personnel can be completed in U.S., Canada, U.K., and Europe.

R. O. Stokes & Co. Ltd.

Stokes patent double acting rake classifier. The interacting rakes are the main feature of this machine and provide a considerable but balanced agitation to the pool of the machine. The effect of this action is to give an overflow free from surging and also to sharpen the degree of separation so that the sands emerge with less than the customary entrained fines.

Also 5 spigot Hydrosizer. Operating principles of this machine described in "Laboratory Equipment" section.

COMMINUTION

Armstrong Whitworth (Metal Industries) Ltd.

Kue-Ken jaw and gyratory crushers. Jaw openings from 12 in. by 2¾ in. to 60 in. by 48 in. and gyratory from 18 in. to 51 in. These crushers on market in U.S. since 1938 and in U.K. since 1951. Wholly manufactured in Britain but not of British design. Delivery availability varies from stock for standard models to 3 months at budget price of £1,000 - £1,600 f.o.b. British ports. On a £5,000 machine average maintenance cost over 3 years is estimated at approximately 10 per cent of initial capital cost.

These jaw and gyratory crushers well known in mining industry. They are operating in many areas, notably New Consolidated Goldfields, Kenya, as well as Mount Isa Mines and the Kalgoorlie Goldfields, Australia.

Selling precluded in U.S.S.R. and Soviet *bloc*, and United States and South America. Training facilities for operating personnel exist in countries where machines operate.

British Jeffrey-Diamond Ltd.

Swing hammer pulverisers. High speed machines using hammers for the reduction of friable materials to a product as fine as 100 B.S. mesh. Range comprises machines with outputs ranging from a few cwt. to 300 t.p.h. On market since 1935, the pulverisers are of British design and manufacture. Available ex-stock or up to 9 months according to size at £500 - £10,000. Used notably by Sierra Leone Development Corp. and in Scunthorpe area. Precluded from no country by existing agreements, spares and servicing are available only in U.K.

The Mud Hog. Generally similar to above except that a travelling breaker plate is incorporated. Wide range of machines. Nominal minimum product ¾ in. except where moisture content and nature of material enable ⅛ in. product to be obtained. On the market 5 years, it is U.S. - U.K. design and U.K. manufacture. Available ex-stock up to 12 months according to size at £900 - £15,000. Used by Stewarts and Lloyds at Corby on iron ore and at Agri-lime, Sussex, on chalk. Other applications regarded as potentially suitable are operations with clay, bauxite and phosphates. Precluded from no country through existing agreements. Spares and servicing facilities available in U.K. only, training for operating personnel in U.S. additionally.

Rock busters. Impact breakers using fixed impeller bars. Breaker bars as secondary breaking medium. Single stage reduction to ½ in. products. Range of 3 sizes giving 10 - 250 t.p.h., dependent on h.p. On market 5 years and again of U.S. - U.K. design, wholly manufactured in Britain. Delivery in 6 - 12 months at a budget price of £2,000 - £8,000 f.o.b. British ports.

Double roll crushers. Range provides 2 - 48 t.p.h. On market 5 years and of all-British manufacture, the crushers are available for delivery in 3 - 12 months according to size at budget price f.o.b. British ports of £1,000 - £18,000. Used by Central Provinces Manganese Ore Co. Ltd., Anglo Great Lakes Corp. Ltd., British Oxygen Eng. Ltd., Aglite, Poland. Possible future application is reduction of lightweight aggregate to ⅛ in. and ¾ in. products.

A group of 42 in. by 50 in. Mud Hogs crushing iron ore

Denver Equipment Co. Ltd.

Range of ball and rod mills from the small 12 in. dia. laboratory unit up to mills of 8 ft. dia. All measured inside the liners. On market over 20 years, the equipment is of British manufacture. Depending on size of unit, delivery lag ranges 2 - 4 months.

Hadfields Ltd.

Jaw crusher (large size) reproduced to scale of a 72 in. by 48 in. crusher, to operate at 120 r.p.m. with 250 h.p. Capacity range from 390 t.p.h. at 7 in. setting to 690 t.p.h. at 12 in. setting. Of British design and manufacture, on market for 6 years, and available for delivery to order (i.e. 9 months approx.).

International Combustion (Export) Ltd.

Hardinge conical mills, widely used for reduction. Conical design gives strength and lightness, griding efficiency. In the larger mining fields Hardinge conicals are griding up to 20,000 t.p.d.

A further development and an addition to this range is the Hardinge conical rod mill. Its principal field is for reducing ores and other minerals either wet or dry from approximately ¾ in. to 10 mesh or for similar narrow ranges of reduction where a granular product is required.

Joy-Sullivan Ltd.

Hazemag impact crushers. Range of almost 20 sizes with capacities 3 - 500 t.p.h. Suitable for primary, secondary and fine comminution. 12 years on market. At present almost entirely imported but it is intended progressively to manufacture the machines. Delivery averages 2 - 12 weeks. Budget prices f.o.b. British ports £500 - £20,000.

Nordberg Manufacturing Co.

Symons cone crusher, used widely in the secondary and tertiary reduction fields. Capacities range from 6 t.p.h. - 900 t.p.h. Machines weigh from 5 - 70 tons. H.P. requirements from 30 - 300.

Of U.S. design and British manufacture, the Symons crusher has been marketed for over 30 years. Some sizes are available from stock, while with others there is a 6 months' delivery lag. Prices range from approx. £3,000 for the 2 in. size to some £18,000 for the 5½ in.

These units work the world over on practically every known mineral. There is no rule as to precluding the crushers from any particular country — each case is considered individually. Spares, servicing and training facilities exist in U.K., North and South America, Australia, Spain, Africa, Scandinavia, Germany and France.

Ross Engineers Ltd.

Design and layout of crushing and handling plants. Feeders, grizzlies, etc. supplied. Wagon marshalling and unloading, primary, secondary and tertiary crushing, screening, conveying, outgoing wagon loading, stockers, reclaiming etc. On market over 30 years and of British design and manufacture. Working with iron ore for Appleby-Frodingham's Seraphim plant and Oxfordshire Ironstone Co., with limestone for A.P.C.M.'s Hope Quarry, and with home and foreign ore, and limestone and basic slag at Guest Keen Iron and Steel Co.

Sheepbridge Equipment Ltd.

Primary crushers. Gyratories and jaw type crushers of various sizes of feed opening for crushing hard and abrasive rocks and ores. " Cuber " impact breaker for crushing non-abrasive rock and ores of medium hardness. A style of gyratory also available for run-of-mine coal.

On market 30 years. Of American and British design and British manufacture. Available for delivery 4-6 weeks depending on size at a price range £1,763 - £68,000. All units designed to minimize maintenance costs. Can be sold in all countries except British Empire (i.e. countries included therein in 1945 but excluding Canada and Australia) and excluding also Egypt, Palestine, Peru. Others by permission.

Also single and double heavy duty slugger rolls of various roll dia. and face widths for primary crushing of shales, sticky materials, medium hard rocks, and ore with low abrasive characteristics. Again U.S.—U.K. design but U.K. manufacture. On market 20-30 years and available 3-4 months according to size. Minimum maintenance. Selling arrangements, spares, servicing and training facilities.

Belt-fed Hazemag impact crusher by Joy - Sullivan

Gyratories and jaws have been supplied for crushing limestone, gravel, slag, iron ore, granite, dolomite, whinstone, quartzite, silica rock and like materials. Cuber Impacta for crushing limestone.

Also secondary gyratory crushers of various bowl dia. and feed openings, and double smooth rolls for crushing hard and abrasive rocks and ores. Cuber impact breaker for non-abrasive rock and ores of medium hardness.

On market 30 years. Again of U.S.—U.K. design but British manufacture. Available in 4-6 weeks at budget prices from £836 - £30,000 f.o.b. British ports. Maintenance costs reduced to minimum by designing. Permissible sales areas as with primary units, as are spares, servicing and training facilities.

Gyratories have been supplied for crushing all types of rock and ore. Rolls for crushing granite and refractories. Cuber impact breaker for limestone.

Also ball and rod mills of various dia. and lengths, electrically driven for grinding ores, coke and stone. The design is British-American, the manufacture British. These have been on the market 20-30 years and are available in 3-4 months depending on size. Maintenance minimized in design care.

Sales arrangements, spares, servicing and training are as previously.

Sturtevant Engineering Co. Ltd.

Hammer mills built on the " open door " principle for ease of accessibility. Made in four sizes. Capacities from a few hundredweights to 50 t.p.h. On market about 30 years. Design originally U.S., but now with British modifications, and manufacture all-British. Small models available ex-stock; large sizes 6 months delivery. Budget prices range from £360 - £2,400 f.o.b. British ports excluding driving gear.

Resonant vibrating mill. Offers an improved means for the rapid and economical grinding of hard materials from a max. 2 mm. down to micron fineness. The machine is the result of 3 years research into problems of vibration milling and incorporates novel design features. Mill is designed for continuous operation. Powered by an 8 h.p. motor and has an all-up weight of about 15 cwt.

This is brand new on market, all British design and manufacture. It is available for delivery from 3 months, depending on size, at budget price f.o.b. British ports of approximately £800.

Crushing rolls, fitted with plain faced rolls, and suitable for secondary reduction. In seven sizes from 8 in. by 5 in. to 36 in. by 16 in. dia. and face, respectively. Capacities from a few cwts. to 20 t.p.h.

Small size supplied ex-stock, but large machines have delivery delay of 6-8 months. Budget prices f.o.b. British ports from £300 - £4,600.

The Patent Lightning Crusher Co. Ltd.

Swing hammer crushers, so designed that they operate effectively as granulators, pulverisers and refuse masticators. Today, company has a range of eight standard size lightning crushers, which have capacities ranging from approximately 1 cwt. to 80 t.p.h. In addition to the standard range of crushers the company manufactures units specially designed for the reduction of wet, sticky or fibrous materials.

Lightning crushers are of all steel welded construction and are heavily lined with wear resisting steels.

CONVEYING

Cable Belt Ltd.

A belt conveyor in which driving pull is taken by two steel ropes, one on either side of the conveyor. The belt serves only to carry material being conveyed. Belt sets across the two ropes and travels with them.

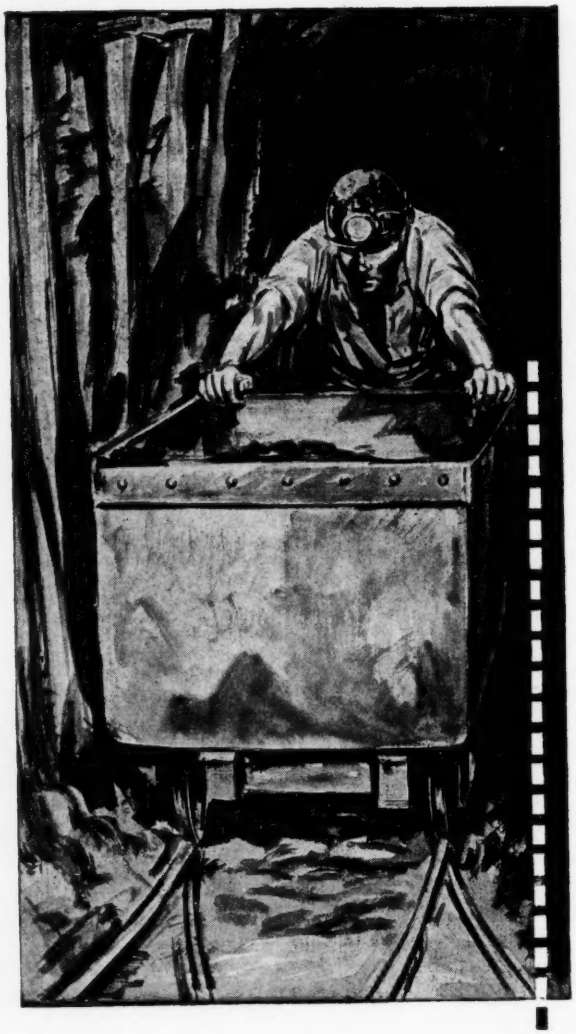
On market 10 years, this is a British design that is manufactured in Britain and also in certain overseas countries by licence agreement. It is available for delivery in about 6 months. The cable belt unit is carrying coal in U.K., France, Australia, Canada, South Africa and Japan; gold ore in South Africa, diamondiferous materials in the Belgian Congo and iron ore in France. Spares servicing and personnel training facilities exist in all major countries.

Distington Engineering Co. Ltd.

High capacity belt conveyor which can extend or retract under its own power, the Distington-Goodman Ropex conveyor.

Was originally developed in America by the Goodman Manufacturing Co. It was introduced to Britain by Distington Engineering Co. Ltd., about eighteen months ago. As Goodman's sole agents in Great Britain, Distington have modified and adapted ropebelt structure to suit British conditions.

Initial capital cost is low, belt wear is substantially reduced, and there has been no recorded instance of belt breakage on British installations. Carrying capacity for



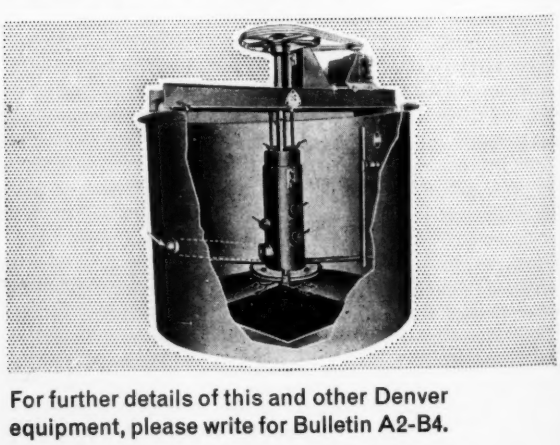
. . . and now Denver takes over

The ore leaves the shaft and Denver equipment comes into the picture for the whole process of mineral recovery—crushing, screening, grinding and separation.

Denver equipment, used by thousands of companies all over the world, is constructed for 24 hours of completely reliable operation a day. Denver engineers are always ready to advise on any problems connected with mineral recovery, from initial laboratory test work, to flowsheet design, selection of the most suitable equipment, and supervision of the construction and starting up of the complete plant.

SUPER AGITATORS

Central standpipe and wearing plate directly over the propeller give pulp a circular motion as it nears the bottom of the standpipe. Pulp particles and reagents are mixed thoroughly, short circuiting and settling out of solids is eliminated.



For further details of this and other Denver equipment, please write for Bulletin A2-B4.

"The firm that makes its friends happier, healthier, and wealthier"

DECO — STANDARD RELIABLE EFFICIENT — 24 HOUR SERVICE — FLOTATION ENGINEERS

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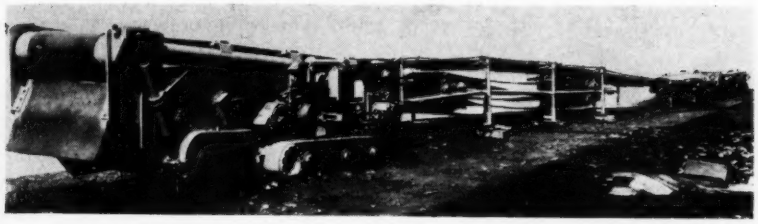


Distington-Goodman Ropex conveyor showing head and tail sections with intermediate structure

a given belt width is up to 20% greater than any conventional conveyor.

Ropebelt is still predominantly a coal mine conveyor in Britain, but it is equally suitable for handling ore and minerals, sand and gravel, below ground, on the surface, and over hoppers. The first two ropebelt conveyors in surface use in gravel quarries in Britain, for example, were installed a few weeks ago. In America, the use of ropebelt at all stages of minerals handling is already well established. An example may be quoted from a gypsum drift mine near Buffalo, not yet in full production, but with a gypsum output already exceeding 300 tons a day. A 36 in. ropebelt conveyor is used to feed raw rock to a crusher. The load is fed to the belt by a shuttle car with a 200 ft. run. Thus, as the face advances, the ropebelt conveyor is extended, until it will reach its planned length of 2,500 ft. Outbye the crusher station are two 24 in. ropebelts in tandem, the first being 1,400 ft. long and the second 250 ft. long. The first of these will be extended to 2,500 ft. when the crusher is moved inbye in about 7 years time. The second feeds on to a special conveyor carrying the crusher output to the surface up an incline of 30 deg.

International Combustion (Export) Ltd.

The Hardinge constant weight feeder, used as a feed for ball, tube and rod mills or dryers. Small, compact, robust unit delivery a constant weight of material irrespective of any change in s.p.g. or size of material on the belt.

W. J. Jenkins & Co. Ltd.

Blanket conveyor. Inclines up to 40 deg. Blanket belt runs at same speed and on top of conveying belt. The two belts motivated through single drive unit by positively coupled twin head drums.

Also conveyor system idlers. 14 in. - 36 in., 3 pulley type, and 24 in. - 60 in. 5 pulley type. Troughing and return pulleys 5 in. dia.

Light type rollers. 3 pulley type. Belt widths 14 in. - 36 in. Idlers 4 in. dia.

Disc type return idlers.

Joy-Sullivan, Ltd.

"Miniveyor", a portable unit from 8 - 20 ft. long, suitable for short or distance conveying. Portable and compact. Six months on market. Of British design and manufacture and available for delivery in 6 weeks at approximately £450 f.o.b. British ports. In service with East and West Midlands Divisions of N.C.B.

Also "Limberoller" and equipment. Single-roll unit freely suspended from two up-out-of-the dirt bearings. It forms its own trough, shapes to the load, and turns on its own axis, making a natural catenary. "Limberoller" idler constructed of neoprene discs moulded on a neoprene-covered steel wire cable attached to a sealed bearing at each end.

"Limberoller" may be used in conjunction with the new "Limberope" idler cradle, which consists of ropes stretched between stands with the Limberoller idler cradle passing at intervals along ropes.

Five years on market. Of U.K. manufacture and available ex-stock. Prices vary according to belt width. Anticipated life easily 10 years. Operating all over world, in particular Denmark, Switzerland, France, India, Poland, Indonesia, Iraq, West Indies, Nigeria, Cyprus, New Zealand, Turkey. Precluded from U.S., Canada and Mexico.

Mechandling Ltd.

All types of belt, slot and bucket conveyors. On market 30 years. Of U.K. design and manufacture, price and availability depends on type. Spares and servicing facilities available in U.K. and the units are precluded from no country owing to existing agreements.

Niagara Screens (Great Britain) Ltd.

Belt conveyors, flat or troughed.

Sheepbridge Equipment Ltd.

Tray or apron conveyors in variety of designs from light pressed steel pans for light and medium duties to heavy cast steel or manganese steel pans for the heaviest of duties. Various widths and lengths of apron with either fixed or variable apron speeds. Electrically driven. Particularly suitable for handling abrasive and heavy lumpy material.

On market 4-5 years and of U.K. design and manufacture, delivery can be made to suit requirements, price depending on width and length. The machine is being continually developed.

Spares, servicing and training facilities exist in U.K. only, and the conveyors are precluded from no country through existing agreements.

Wharton Engineers (Elstree) Ltd.

All-steel conveyor with overlapping curved pans connected by central driving chain carried on rollers attached to certain pans. Specially designed for carrying hot and/or abrasive materials and can operate around bends in both horizontal and vertical planes. Handles hot materials up to 1,000 deg.C. Can elevate up to 80 deg. from the horizontal and can elevate sticky material.

On the market for seven years, it is of British manufacture. Available for delivery in 6 months. Examples of maintenance expenditure are when elevating foundry sand over 25 ft. rise through 3 year period, cost of labour and maintenance 3s. 4d. per ton. Carrying knock out sand and tramp iron rate .1d. per 100 ton/ft. Serving in U.K., Continent, Ireland, Canada and Brazil. Companies respectively are St. Patrick's Copper Mines, Associated Chemical Companies (U.K.), Albright and Wilson Ltd. (U.K.), and I.C.I.

DRYING

Dorr-Oliver Co. Ltd.

Fluosolids for roasting, calcination and drying.

Alfred Herbert Ltd.

The Atritor Dryer Pulveriser, a compact, medium speed air swept, unit pulveriser which dries, grinds, classifies and delivers in one operation a wide variety of materials, some of these being ball, china and fireclay, gypsum, limestone, chalk, peat, coal, sludges, filter cakes and so on. The machine does not require external driers, drying being performed by a supply of hot air gas from a small adjacent coke, gas or oil fired air heater.

Manufactured in seven different sizes, each size being available in either the internal or external fan design so that the finished product can range from a coarse granulated material to a superfine face-powder-like product. The Atritor is quiet in operation, compact, and due to its compact nature is highly efficient as both a dryer and a grinder.

On the market 40 years, it is of British design and is manufactured wholly in Britain, also under licence in Belgium. Belgian licence covers France and Netherlands. Delivery depends upon the scope of the equipment being provided. It is generally possible to meet delivery requirements.

Prices are dependent upon the size and scope of the application.

Current users and applications include, Associated Portland Cement Manufacturers and their subsidiaries, using the Atritor for kiln firing, and the grinding of chalk and limestone; I.C.I., kiln firing, drying and grinding of various types of chemicals;

Mavor and Coulson 30 in. troughed belt conveyor carrying platinum ore to a treatment plant in South Africa

Courtaulds, drying and grinding of coal for briquetting ; English China Clays — drying and grinding china clay, ball clay, etc. ; British Plaster Board, drying and grinding gypsum and gypsum filter cakes ; Fullers Earth Union, drying and grinding Fullers Earth, both as dug and in the filter cake form ; Rogers & Cooke, drying and grinding chalk, both as dug and in the filter cake form ; Ben Bennett, Derbyshire Stone and many other installations, drying and grinding limestone ; Cape Asbestos, drying and grinding calcined kieselguhr and diatomite and clays ; and Morgan Refractories, drying and grinding many types of clays.

Sales organisations cover most of the world, and in some countries spares are available from stock, but in all instances where the manufacturers are represented, a service is available.

The Atritor combined dryer and pulveriser will cover virtually all materials that require drying, grinding or a combination of the two. There is virtually no limitation as far as moisture content is concerned; as far as grinding is concerned, there may be one limit covered by hardness, but in all cases a Test House is available in Coventry for tests on customers' materials. Facilities for training personnel exist in U.K. only.

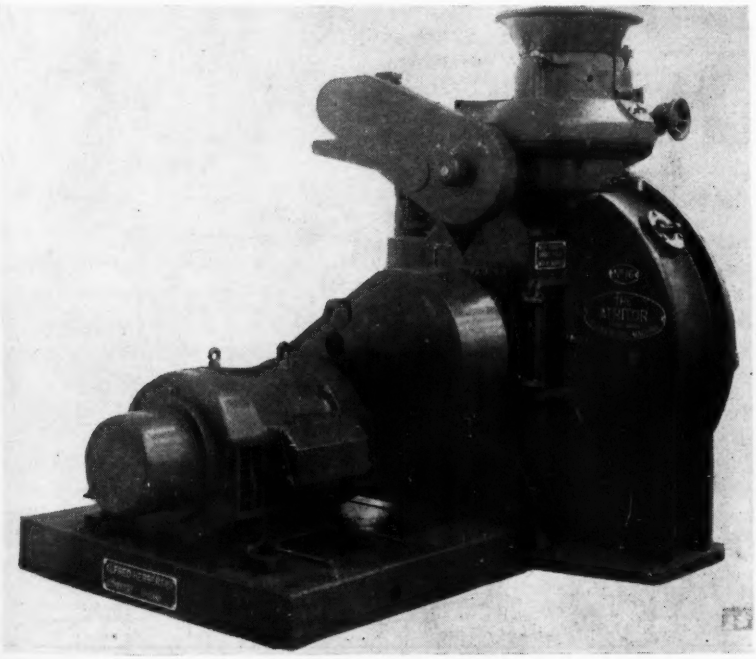
DRY SEPARATION

Rapid Magnetic Ltd.

High intensity separator, Type M.J., for heating free flowing granular materials. On market 5 years, of British design and manufacture, it is available for delivery now. Giving service to glass and abrasives manufacturers, and the glass technologist to the government, Uttar Pradesh, Kanpur, the equipment also gives selective separation of different minerals when required. Modifications are under consideration and the Type M.J. is precluded from no country owing to existing agreements.

Also a number of other types.

The Atritor dryer - pulverizer by Alfred Herbert Ltd.



Sturtevant Engineering Co. Ltd.

A new range of high voltage electrostatic separators, type O.H. Several sizes are made. (For operational principles see section " Laboratory Equipment ".) The larger machines of the range operate with the same type of power pack and include similar controls. Standard units are built having two rolls in each, either 24 in., 48 in. or 60 in. long. Orders already executed and those in hand, take these Sturtevant separators to practically all the continents of the world. These separators reach commercial outputs of over 4 t.p.h.

The pneumatic classifiers used for classifying dry powders in closed grinding circuits have a range of sizes from 3 ft. dia. to 16 ft. dia. and capacities from a few cwts. to 30 - 40 t.p.h. depending on fineness of product. On the market 30 years, these separators are of British design and manufacture in U.K., South Africa, and Spain. The units are available for delivery in from 3 - 6 months at prices from £500 - £5,000 f.o.b. British ports.

These units are in general use, mainly on phosphates, etc. with applications where a graded powder below 100 mesh is required. Training, spares and servicing facilities in U.K., Spain, South Africa. Improvements are incorporated as operating experience indicates. The equipment is precluded from no country owing to existing agreements.

Davies Magnet Works Ltd.

Model 40 drum separator for extraction of high ferrous materials. Standard magnetic drum 12 in. by 14 in. face. Electro-magnetic or permanent magnetic models available. Permanent magnets, where fitted, high intensity long life Alcomax 11. Equipment complete with built-in motor drive and starter together with full wave rectifier for magnet energization where applicable. Fully assembled ready for immediate operation upon connection to mains electric supply.

Of British design and manufacture, it is available in 16 - 18 weeks. Expenditure on depreciation and maintenance negligible.

The Type M.J. induced roll separator by Rapid

These remarks concerning design, availability and depreciation apply equally to Model 41 electro magnetic pulleys. There are high intensity electro magnetic pulleys fitted with maximum strength vacuum impregnated energizing coils, heavy coil covers, and bronze cast end rings. Equipment supplied completely wired with slip rings and brush gear. (Provision for wide carrying bearings, and including standard keyway provision for mounting on main drive at site.) Sizes from 10 in to 42 in. dia. and from 12 in. to 48 in. feed belt widths.

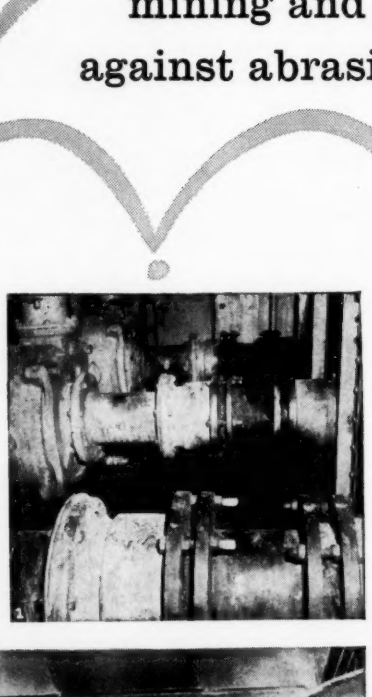
Model 42 is of the high intensity non-entraining induced roll type, fitted with twin 10 in. electrically operated feeders, adjustable take-off roller variable according to mesh size under treatment. Suited to single mineral separations at high feed rate with special application to fine mesh feeds. Again U.K. manufacture and design, and available in 16 - 18 weeks at approximate budget price £580 f.o.b. British ports.

Model 45 laboratory and prospecting electro magnetic separator. High intensity small scale unit of disc type incorporating non-entraining features. Infinitely controllable electric vibrating feeder. Feed cropper with regulating gate. Adjustable take-off magnet disc. Built-in full wave rectifier for magnet energization with all regulators for field control. Mounted on solid cast bedplate fitted with motor drive and starter. Weight 196 lb. at 12 in. by 25 in. by 30 in. Of British design and manufacture and available in approximately 8 weeks at around £270 f.o.b. British ports.

Also Model 47 magnetic separator, of disc pattern. Two products per disc and readily adjustable air gap. Conveyor feed infinitely variable while in operation from zero to 425 f.p.m. Weighs 6,944 lb. and measures 10 ft. 7 in, by 5 ft. 1 in., by 5 ft. 8½ in. Of British design and manufacture, it is available in 16 - 18 weeks at a budget price of about £2,200 f.o.b. British ports.

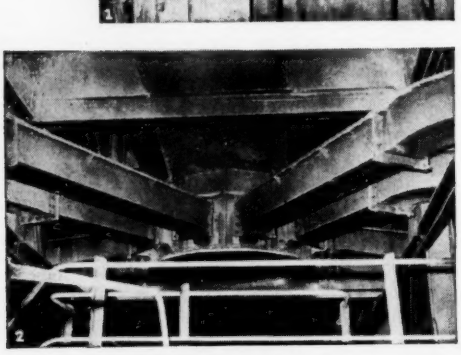
Also Model 50 magnetic separator. Twin 10 in. controllable electrical vibrating feeders. Feed hoppers with gate control. Three take off ring (adjustable). Weighs 1,792 lb. and measures 7 ft. 6 in. by 3 ft. by 4 ft. 8 in. Budget price approximately £1,000 f.o.b. British ports. Also Model 51, a large scale model of No. 50. Four 14 in. controllable

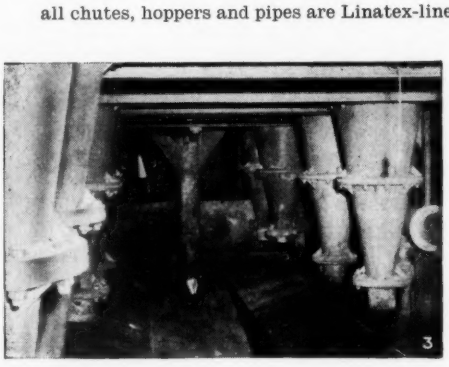
How to protect mining and industrial plant against abrasion and corrosion?

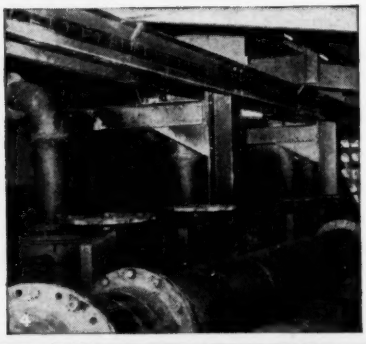


There's a wide range of Linatex-lined equipment designed to meet these very problems. Consult your nearest Linatex organisation. Their experience and prompt advice are always freely available.

These photographs were recently taken in a Malayan Tin dredge. The Linatex equipment invested in this plant includes: six—8″ Linatex Pumps, eighteen—8″ Linatex valves in the distribution pipe work and twelve—24″ Linatex-lined cyclones. And, of course, all chutes, hoppers and pipes are Linatex-lined.







1. View of Port pump well.
2. View of Linatex-lined distribution box and chutes.
3. View of cyclone underflow and discharge hopper.
4. View of Linatex Valves and cyclone manifold.

LINATEX

WILKINSON PRODUCT

The first line of defence against abrasion.

6 of the 15 Linatex factories in the world. Any of them will see that your enquiries receive energetic attention.

U.S.A.	MALAYA	AUSTRALIA	CANADA	ENGLAND	SOUTH AFRICA
Linatex Corporation of America, P.O. Drawer D, Stafford Springs, Conn., U.S.A.	The Wilkinson Process Rubber Co. Ltd., Batu Caves, Selangor, Fed. of Malaya.	Linatex (Australia) Pty. Ltd., David Street, Dandenong, Victoria, Australia.	Wilkinson Linatex Co. Ltd., P.O. Box 1310, Station O, Montreal 9, Quebec, Canada.	Wilkinson Rubber Linatex Ltd., Camberley, Surrey, England.	R. J. Spargo Ltd., P.O. Box 7128 Johannesburg, South Africa.

L64(M)

electric vibrating feeders. 4,866 lb. and costs approximately £1,800 f.o.b. British ports. In both these cases, British design and manufacture, and delivery in 16-18 weeks.

Huntington, Heberlein & Co. Ltd.
High intensity magnetic separator comprising 1-3 magnet assemblies. Particularly suitable for separation of feebly magnetic minerals such as wolfram, columbite, ilmenite. Separator is of Wetherill cross belt type, standard machine is feedbelt of 18 in. width. On market 30 years, of British design and manufacture, it is available for delivery in approximately 4 months. Low maintenance expenditure. The units are used in Portugal for separating wolfram from wolfram-tin concentrates, in Nigeria for separating columbite, and in U.K. for separating wolfram concentrates. Precluded from no country by existing agreements.

Knapp and Bates Ltd.
Vibrair dry concentrating table. Patented. A dry separation machine making separations by density, size or shape differences and suitable for handling materials sized —3 mesh to + 100 mesh. Up to 4 per cent moisture can be tolerated. From the laboratory and batch models (20 in. by 12 in. and 42 in. by 27 in.) at maximum capacities of 300 and 1,100 lb./hr. repectively, outputs range up to the No. 3 at 108 in. by 72 in. with an output of 7,000 lb./hr. On the market eight years, the Vibrair is of British design and manufacture. It is available in from 8 - 10 weeks according to model in prices f.o.b. British ports as follows : lab. £675, Batch, £1,175, No. 1 £1,575, No. 2 £1,950 and No. 3 £3,200. Expenditure and maintenance costs less than 10 per cent p.a. of the cost price.

The Vibrair is working now in government laboratories in the U.K., Morocco, France, Australia and Egypt. In commerce, it is operating with Bagole Graphite in Ceylon, Zucan-Rutile Pty., in Australia, as well as in diamonds with the South West Africa Co. and with tin-columbite in Nigeria.

DUST COLLECTION AND DISPOSAL

Joy-Sullivan Ltd.
Joy Microdyne dust collector. Compact, wet inertial unit, 1/10 to 1/20 the size of any other collector. Collects over 99 per cent of all dust particles 5 microns and 92 per cent of 2-micron dust, and substantial amounts of smaller dust. Cylindrically shaped, it installs directly into the duct system, often at the point of use. Available in ratings 2,500 - 64,000 c.f.m.

Imported from the U.S. parent company, the Microdyne has been on the market 5 years. Prices vary on size and materials used in construction. £700 - £30,000 f.o.b. British ports. Used at N.C.B. Central Engineering Establishment, Bretby, it is for sale only in the U.K. from British sources. Throughout world from U.S.

Lodge-Cottrell Ltd.
Precipitators for the collection of dust from gases and fume arising from ore roasting and processing plant. On market 48 years and of British design and manufacture. Used at National Smelting Co. Ltd. and Royal Mint refinery. Spares and servicing facilities in U.K., South Africa, Australia, Belgium. Training facilities in Britain.

J. T. Meredith (Heating) Ltd.
Metal prefabricated trunking with fans, air washers and dust removal equipment. Designed, manufactured and installed to suit individual case. Of U.K. design and manufacture delivery is made to suit requirements. Used at St. Patrick's Copper Mines, Avoca, Eire. Spares and servicing facilities exist in U.K. Personnel training given anywhere during installation.

FLOTATION

Armour Hess Chemicals Ltd.
Manufacture at their British factory a range of cationic flotation collectors which are long chain primary and secondary amines (Armeens), diamines (Duomeens) or their acetate salts (Armacs, Duomacs), as well as quaternary ammonium compounds (Arquads). These find increasing usage not only in metallic but mainly in non-metallic ore flotation. They are used for selective flotation of silica from phosphate rock, mica and spodumene and for concentration of feldspar for floating silica, mica, pyrites from calcite or Kyanite and for silica from iron ores; monazite is floated from a variety of heavy minerals; sylvite (potash) from halite.

Denver Equipment Co. Ltd.
No. 12 spiral trough wet reagent feeder. Recently introduced to market and of British design and manufacture. Available in approximately 6 weeks at a budget price of £130 f.o.b. British ports. Annual expenditure on maintenance and depreciation considered negligible. Entirely new model as it has many detailed improvements over the previous type. It is particularly suitable anywhere it is necessary to feed reagents, corrosive or otherwise.

Also Sub-A flotation cells. Some 30,000 Denver Sub-A flotation cells installed throughout the world.

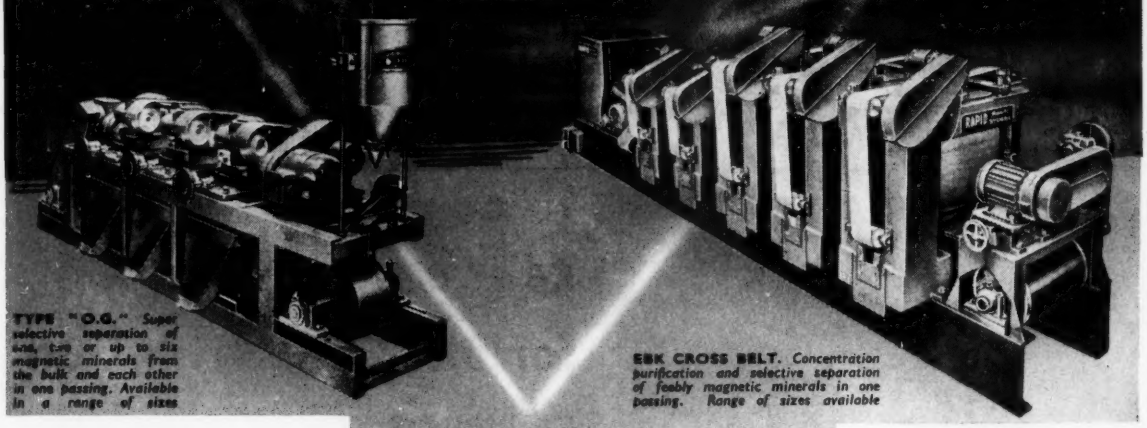
RAPID

Magnetic

SEPARATORS

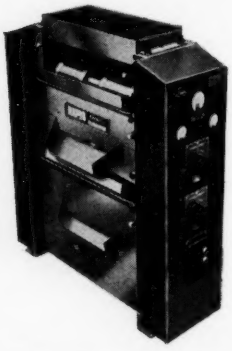
for

FEEBLY MAGNETIC ORES



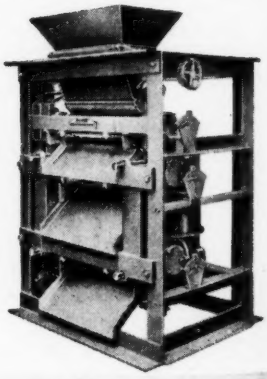
TYPE "O.G." *Super selective separation of one, two or up to six magnetic minerals from the bulk and each other in one passing. Available in a range of sizes*

EBK CROSS BELT. *Concentration purification and selective separation of feebly magnetic minerals in one passing. Range of sizes available*



IN all those climes where mineral winning is conducted you will find these famous machines treating Wolfram, Columbotantalite, Titanium Ore, Chromium, Limonite, Iron sands, Corundum, Monazite sands, Rare earths—indeed most minerals of feebly magnetic character

World user equipment of high repute



M.J. TYPE SEPARATOR. *High speed separations and extraction of one magnetic mineral. Multi units for difficult ores where selective separation is required*

BACKED BY MORE THAN HALF A CENTURY OF EXPERIENCE

INDUCED ROLL. *Purification and concentration of free flowing granular material. 2 to 6 Roll Models. Additional Rolls improve recovery and separation*

TELEPHONES: VICtoria 1137

RAPID MAGNETIC LIMITED
LOMBARD STREET, BIRMINGHAM, 12, ENGLAND

TELEGRAMS: "MAGNETISM", BIRMINGHAM

Float-Ore Ltd.
A wide range of anionic and cationic collectors, as well as frothers, depressants, dispersing and wetting agents.

Holman Brothers Ltd.
Holman-Mitchell table flotation equipment. Action through jetted pipes causes flotation on deck of table on pre-conditioned material.

Imperial Chemical Industries Ltd.
Chemicals to the mining, smelting and refining industries throughout the world. Perhaps outstanding of the products is Cassel brand sodium cyanide, for 60 years used in every gold-producing country, and since the advent of froth flotation as a depressant.

Other examples of the widespread use of I.C.I. products by the metal mining industry are lime produced from the limestone quarries in Derbyshire, used by the Ghanaian Gold Mines, sodium hydroxide for the processing of bauxite in Jamaica, beta-naphthol used by electrolytic zinc plants in Canada, thiocabanilide and mercaptobenzthiazole in Canada and Australia respectively as flotation collecting agents, sodium sulphide by North African mines treating oxidized lead ores, and "Sedomax", a comparatively recently developed flocculating agent, is in increasing demand for the treatment of coal washery effluents.

International Combustion (Export) Ltd.
Agitair flotation machine. Embodies original design features plus improvements resulting from operation and service. Experience has dictated the necessity of building a flotation machine to suit each individual problem; i.e. Agitair with simple changes of impelled characteristics can function as a rougher, a cleaner or a scavenger in both metallic flotation circuits, and will handle varying degrees of grinding and s.p.g.

The four standard commercial units give froth areas per cell of 1.56 sq. ft. up to 16 sq. ft. Total volumes per cell range from 1.95 cu. ft. to 40 cu. ft. The individual units of the range are constructed with 2, 4 or 6 cells, and air requirements grade from 10 cu. f.p.m. up to 75 cu. f.

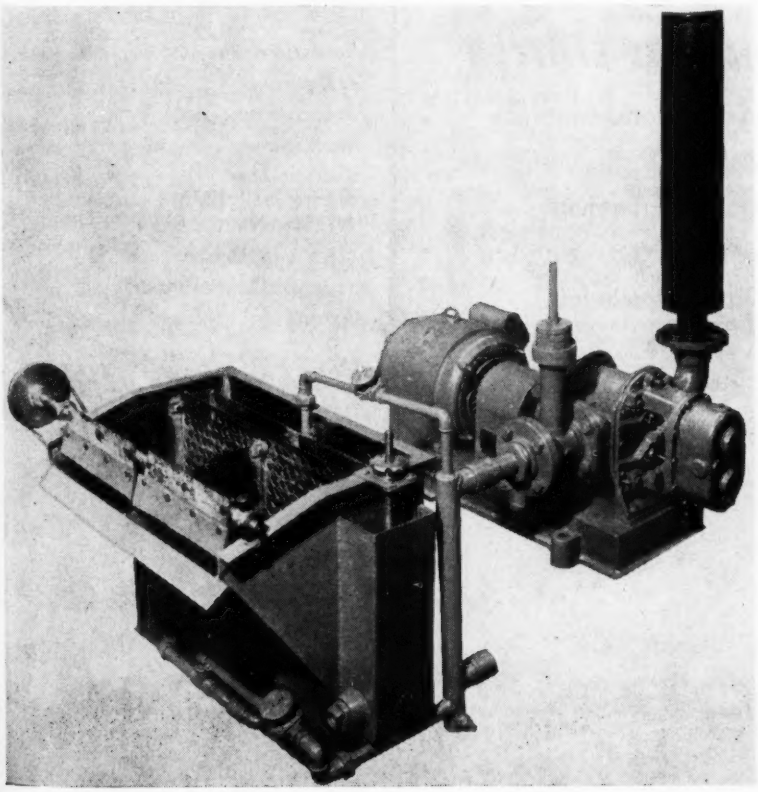
Knapp & Bates Ltd.
The patented pneumatic flotation cell, a machine constructed as twin-cell units in tanks of same dimensions as Sub-A cells, and incorporating patented air-lift-air-diffuser principle to avoid sanding up. More suitable for —120 mesh material. On market five years, it is of British design and manufacture and is available for delivery in 6 - 8 weeks. Prices depend on size of air blower, which in turn depends on number of cells. Typical annual rate of expenditure or depreciation and maintenance claimed as less than 12½ per cent of purchase price.

Also Sub-A flotation cells that comprise a new range of worm gear drive, hollow shaft Sub-A cells with separate aeration and agitation impellers.

Market eighteen months, cells of British design and manufacture. Available for delivery in 8 - 12 weeks according to size at £650 - £1,950 per twin cell unit according to size in standard construction. Research and development continue, the cells are precluded by existing agreements from U.S., Canada and Peru. Spares, servicing and personnel training facilities exist in the U.K. only.

Patents are pending for the disc-type wet reagent feeder. This is a multi-compartment wet reagent feeder in which liquid picked up by slowly revolving discs is wiped off by P.T.F.E. blades. Control of quantity is gained by adjusting position of blades to wipe greater or lesser area of disc. On the market two years, the machine is of British design and manufacture. It is available for delivery in 4 - 6 weeks at a budget price of approximately £100 - £650 f.o.b. British ports,

The Knapp and Bates pneumatic flotation cell



Mechandling Ltd.
"Geco" flotation machines. On market 30 years. Of U.K. design and manufacture, availability and price depend on quantity and size. Annual expenditure, depreciation, and maintenance considered negligible. Spares and servicing facilities exist in no country, nor is the unit precluded from any area owing to existing agreements.

HEAVY MEDIA SEPARATION

Fairleede Engineering Ltd.
Complete range of Heavy Media Separation plant.

Huntington, Heberlein & Co. Ltd.
Company's sink and float process is based on use of a non-ferrous suspension and where applicable indigenous mineral used to prepare suspension. Plants are in use ranging from 100 - 10,000 tons of sink and float feed per day. Operating in various parts of world. On market 30 years and of U.K. design, the company always prepared to consider manufacture in the country of use. A plant of normal size usually 12 - 15 months for delivery.

Serving in Italy, Sardinia, Sweden, North Africa, the units are particularly suitable for separation of a mine ore where density differential between gangue and matrix is small. Precluded from no country by existing agreements.

Liquid - Solid Separations Ltd.
Produced by the manufacturers are a laboratory hydrocyclone test set in Pyrex. Pump unit for it. Standard rubber-lined hydrocyclones in dia. 30, 75, 150, 300 and 600 mm. Multihydrocyclones, including 15 mm. dia. unit in nylon or other plastics.

On market 8 years. Of U.K. design and manufacture, equipment is available ex-stock up to 3 months at prices from £30. Used for degritting, desliming, dewatering, degassing, deflocculation. General classification and washing applications. H.M.S. and liquid - liquid separation.

The General Electric Co. Ltd. of England
Company supplies a very wide range of equipments for use in mineral dressing operations.

Wilkinson Rubber Linatex Ltd.
Linatex linings for tanks, cones, etc. Equipment described fully in section "Transportation".

Automatic Coal Cleaning Co. Ltd.
"Acco" wet magnetic separator for cleaning dilute medium with density control. When the separated products from the bath have been sprayed, medium diluted by the spray water is treated for the recovery of magnetite and to control the slurry content. Excess slurry will increase the viscosity of the medium and also make it difficult to control the specific gravity. In operation the magnetite is carried along a continuous rubber belt, running over an electromagnetic drum of high intensity which is partially immersed in the medium. The drum is suitably sealed to prevent the ingress of moisture and is oil-filled to dissipate any heat generated in the coils. The discharge from the bottom of the tank is sent for retreatment in a secondary machine whilst the clarified water overflow is utilized by the screen sprays.

Acco magnetic separators suitably installed—e.g. with one or more primary machines followed by a secondary machine —give for heavy medium recovery a total yield of more than 99.9%. The machine is driven by a 2 or 3 h.p. motor and the magnetic drum absorbs approximately 22 amps. at 220 volts. d.c.

Also " Drewboy " separator, recently introduced to U.K. after operation in Europe for some years. Low magnetite consumption claimed and accurate separation up to spg. of 2.0. Use of this equipment claimed as advantageous for separation of coals at spg outside range of Baum jig, and to treat run-of-mine outputs from +24 in. to ¼ in. Up to 225 t.p.h. can be separated from raw feed in single machine. Machine can deal with 220 t.p.h. of sinks in feed. Float is removed by paddle wheel with flexible flights and the shale is removed from the bath by means of a radial-vaned wheel mounted on an inclined shaft at the side.

Machines have been proved and tested, not only in U.K. and on the Continent, but also in Australia, South Africa, India, Turkey and Eire. Although hitherto applied almost exclusively to coal cleaning, are suited to the wider field of mineral dressing.

HYDRO-METALLURGY

Chemical Construction (G.B.) Ltd.

Sulphuric acid concentrator. The range has been constructed since 1915 and two types have been evolved. First, drum type in which hot combustible gases are blown through the acid. Second, flash film type in which acid is concentrated under vacuum as it cascades through a series of steam jacketed pipes.

Both types operate continuously. Drum type handles dirty acid and concentrates it to 93 per cent H_2SO_4. Has been successfully used for the concentration of weak rundown acids from ISOPROPANOL, ETHANOL and ANILINE processes. Flash film type operates best on clean acid to yield a strength of about 91 per cent H_2SO_4.

Imperial Chemical Industries Ltd.

See notes under " Flotation ".

The Permutit Co. Ltd.

Manufactures a wide range of large fully automatic ion exchange equipment used for recovering uranium from leach liquors. This plant has been supplied to uranium mines throughout the world and represents the largest non-water application of ion exchange in the world.

The Acco " Drewboy " dense medium separation bath

LABORATORY APPARATUS

Chas. W. Cook and Sons Ltd.

Laboratory magnetic separator. Essentially a laboratory scale apparatus for fine dry separation of minerals, etc., comprising powerful electromagnet with pole pieces of special design, feed hopper, double track non-magnetic pan with vibrator, divided chute and two collecting buckets. For free-flowing materials a vertical free-fall device can be supplied. Originally designed Cambridge University and has been sold to many foreign universities. Wholly manufactured in Britain, has been on market 6 years.

Available for delivery normally in 4 weeks, at budget price £595. British ports plus £30 f.o.b. and packing for export. Annual depreciation rate negligible.

Delivery made ex-stock. Precluded from no countries by licensing or other sales agreements, no modifications in design are contemplated.

Denver Equipment Co. Ltd.

12 in. dia. laboratory unit ball-rod mills. Fully described under " Comminution ". Leading universities and training establishment in U.K. have these mills.

Laboratory scale 4-cell Sub-A flotation machine. Similar to a unit of larger unit. On market since 1927 and of U.K. manufacture; it costs £682 f.o.b. British ports and delivery time is approximately 6 weeks.

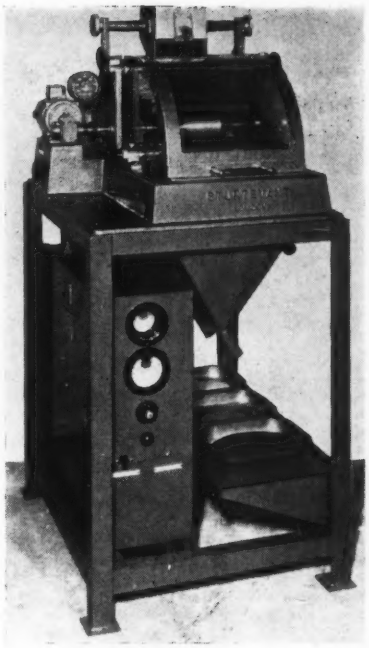
Precluded from no country by existing agreements, spares, servicing and training facilities exist in U.K., United States, Canada, South America, South Africa and Australia.

International Combustion (Export) Ltd.

Full range covering the Raymond laboratory mill, the Raymond laboratory separator, the Rotap testing sieve shaker, Ty-lab tester, elutriators; sample splitters and reducers.

R. O. Stokes & Co. Ltd.

The 5-Spigot Hydrosizer. This hydraulic classifier is a laboratory version of the machine that is well known for the treatment of minerals having high economic value. Equipped with a specially designed servo-acting valve for controlling the spigot discharge, it has all the functions of the full size machine and is capable of handling a minus 1 mm. feed at rates between 1 - 1.5 t.p.h.



The Sturtevant laboratory electrostatic separator

Sturtevant Engineering Co. Ltd.

A new range of high voltage electrostatic separators type O.H. Several sizes are made, from a small laboratory machine up to large commercial separators.

The Laboratory model has many novel features and is fitted with an entirely new design of power pack to supply the high voltage uni-directional current. With this power pack it is possible to employ any voltage up to 40,000 volts simply by turning a knob on the control panel.

The separating zone is enclosed in a cover fitted with large Perspex windows through which the separating process can be watched. The combination type of electrode permits high rates of treatment with selective separations, and it is possible to separate some combinations of minerals, which were too difficult in the past, to enable the electrostatic separating principle to be economic.

Two types of feeder are supplied, one to deal with all normal samples and the other to deal with very small samples. A heater is fitted to raise the temperature of the material when necessary.

The Permutit Co. Ltd.

Featured on the stand is the portable Deminrolit unit, a small scale version of the well-known industrial range of Deminrolit plant, which produces very pure water for process requirements. The portable Deminrolit can produce up to 12 gal. of water hourly having a conductivity of less than 1 microhmo per cm^3.

PROCESS CONTROL EQUIPMENT

Mechandling Ltd.

" Geco " automatic electric sampler. Used for extracting samples of materials being processed for assay and laboratory tests. Samples removed by traversing cutter through the stream at pre-determined intervals automatically. On market 35 years, it is available in 6 - 8 weeks. Of U.K. design and manufacture, the sampler

costs £250 - £400 depending on size required (18 in. - 72 in.). Annual rate on maintenance and depreciation considered as negligible.

Many of these machines operating all over the world. N.C.B., New Consolidated Goldfields, Rio Tinto Mines, Cyprus Mines, Kimingi Gold Mines, New Goldfields, Venezuela, Norando Mines, Potash Co., Mexico, Idaho—Maryland Mines, California.

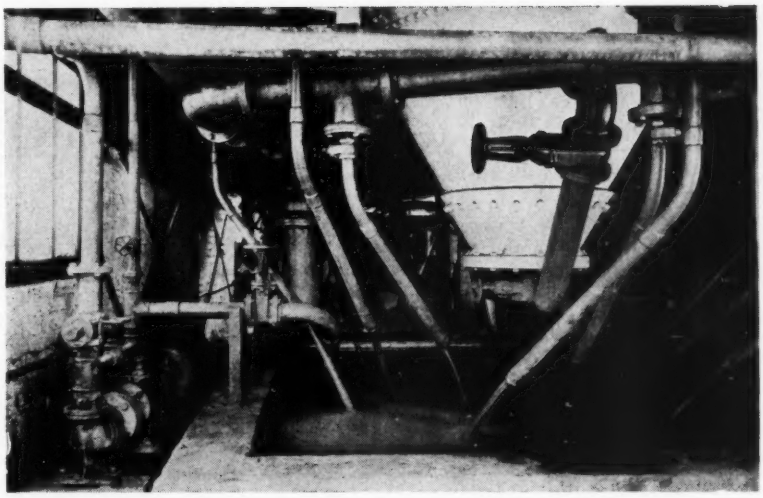
Precluded from no country by existing agreements, the machines have spares and servicing facilities in U.K. only.

PUMPING

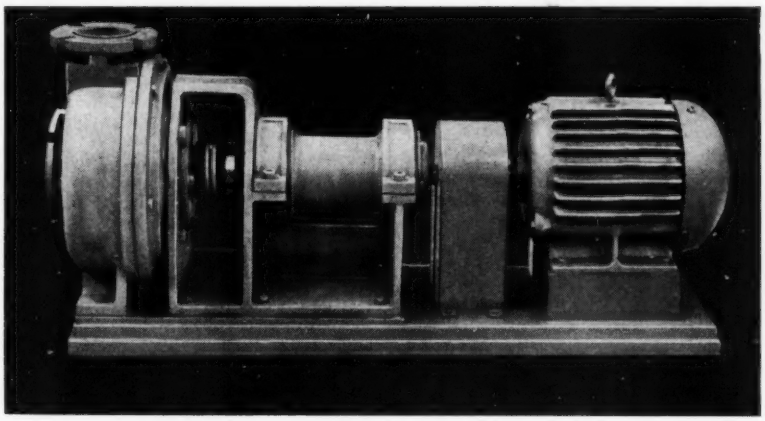
British LaBour Pump Co. Ltd.

Vacuum extraction pumps Type SGPL-T, self-priming pumps Type UHL for effluents and slurries, hooded suction pump Type Q as used in Ndola and Mufulira refineries on copper sulphates, rubber lined pumps as used at Nkana (Type UHL-T), effluent self-priming pumps Type BG, and acid resisting pumps such as the Q types used on copper sulphate at Nkana.

On the market 30 years of partly American design and wholly-British manufacture. Available for delivery in 4 weeks in certain cases, annual rate of expenditure on maintenance and depreciation is estimated at 10 - 15 per cent. Spares are available throughout the U.K. and servicing from agents. Precluded from no country through existing sales agreements, the manufacturers plan a modified version of the Type Q in the Type SQ.



Above, is a D 72 Mono pump installed at Ellistown Colliery, delivering effluent from washery to waste heap. Below, in centre of page, the Craig ceramic lined centrifugal pump



Below, at bottom of page, The British LaBour SGHL - T pump for vacuum extraction duties

Mono Pumps Ltd.

A range of pumps for slurries and effluent materials. On market 25 years and of U.K. design and manufacture. Available ex-stock. Spares and servicing facilities exist in all countries except Russia and associated nations, U.S., and Canada.

Mono pumps for slurry pumping are usually arranged for V-belt drive from electric motors. Speed of rotation varies according to solid concentration. A method of filter pressing is being adopted in many N.C.B. areas by pumping slurry directly to one or more filter presses. Operating pressures 50 - 100 lb. p.s.i. with solids concentration 20 - 35 per cent.

K. W. Chemicals Ltd.

Craig ceramic lined centrifugal pumps, developed to handle corrosive liquors and corrosive liquors containing small solids in suspension. These pumps can be supplied with conventional packed glands or with a range of mechanical seals the latter being back flushed with clean liquor when handling liquors containing suspended solids.

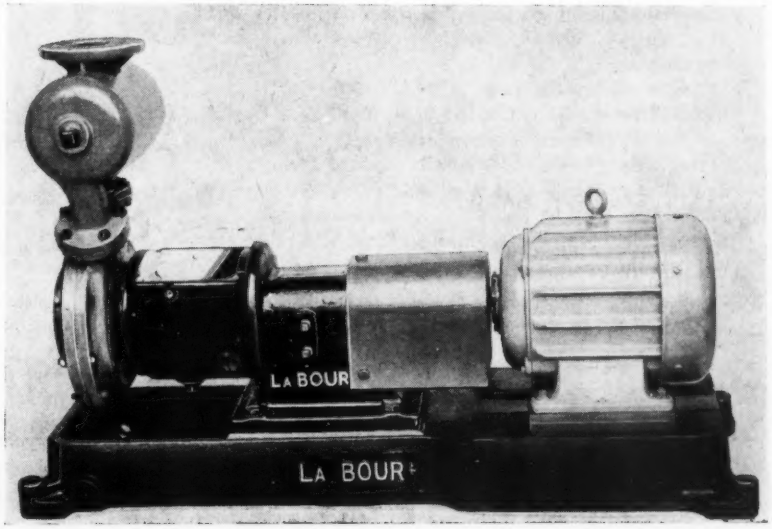
The impellers are of the open type and can be supplied in tough acid resisting ceramic or in metal alloys as required and educator vanes on the back of the disc assist in reducing gland pressure and rejecting suspended solids from the stuffing box or seal. Covers duties to 120 ft. head and capacities to 300 g.p.m.

A range of small ceramic lined hand operated and motor driven diaphragm pumps are also available giving capacities of the order of 350 g.p.h. and discharge pressures to 30 lbs. p.s.i.

Dorr-Oliver Co. Ltd.

A. R. Wilfley & Sons centrifugal sand pump specifically designed for all types of abrasive slurries, pulps and slimes. Glandless and external adjustment is provided to take up wear, pumping parts being in special wear resisting alloys. Requiring low maintenance, this pump can be provided for volumes of 10 - 3,600 g.p.m.

Oliver diaphragm slurry pump, Dorrco diaphragm suction pump, A. R. Wilfley and Sons centrifugal acid pump.



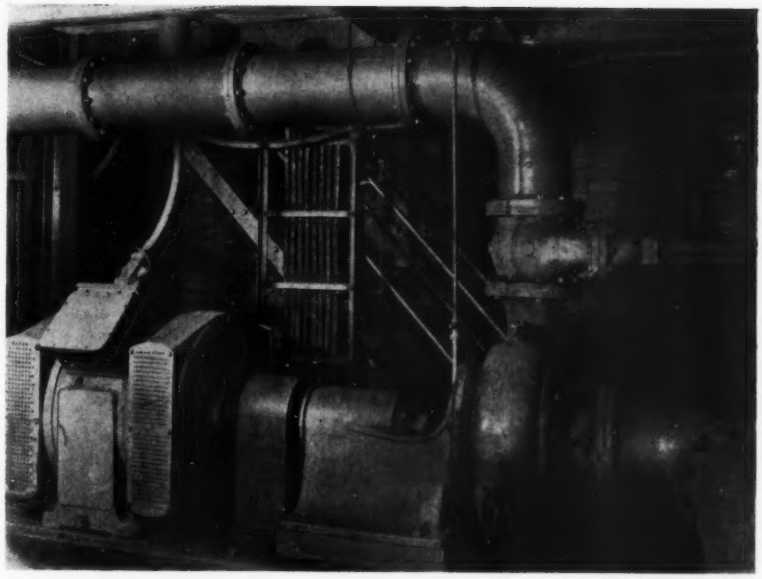
The Tangye no-choke pump

Tangyes Ltd.
Used in coal preparation plant, B Type range for heads up to 75 ft. and "No-choke" for heads over 75 ft. Max. head for No-Choke given as 80 ft. standard, larger to order. Capacities (standard) 3,000 g.p.m. Pumps up to 6 in. size will pass any solid able to enter pipe.

Geo. Scott & Co. (London) Ltd.
Scott-Wemco pump. Special centrifugal with impeller recessed allowing free flow without impeller blades, etc. making more than minimum contact with product. Blockage free operation. On market 5 years of U.S. design and British manufacture. Available in 6 weeks at a budget price f.o.b. British ports of approximately £250 - £1,000, according to size (5 sizes).

Works with limestone and cement slurries, nickel, magnetite, iron ore, coal, etc. Several hundred pumps operating in U.S. Also applicable for crystalline slurries. Precluded from all countries save U.K., Holland, Belgium, Denmark, Australia, India, South Africa. Training facilities exist in U.K., spares and servicing in U.K., Holland, Belgium, Denmark. Plans exist for modifying the pump.

Also Meader pump, a reciprocating pump for handling semi-solids. Hydraulically operated. Various sizes. On market 6 years and of U.K. design and manufacture, the units are available in 6-8 weeks at £975 - £2,500 (5 sizes) f.o.b. British ports. Training facilities in Australia and Canada; plans exist to modify the range.



International Combustion (Export) Ltd.
Vacseal pump, manufactured and marketed in various countries, for handling thick and abrasive pulps such as are commonly met with in ore reduction plants, and abrasive slurries. Need for gland sealing water is eliminated in the Vacseal.

Smallest of range, size 2 in. has limiting capacity of 30 - 150 g.p.m. whilst largest size 8 in. has limiting capacity of 1,500 - 2,500 g.p.m. These pumps deliver against heads of 80 - 100 ft. and can take suction lifts up to 10 - 12 ft. These pumps handle slurries containing as much as 70 per cent solids by weight.

Wilkinson Rubber Linatex Ltd.
Linatex centrifugal pumps, for handling abrasive slurries. Fitted with V-rope drive from electric motor or I.C. engine. Capacities from 10 g.p.m. to 3,500 g.p.m. On the market 25 years, it is of U.K. design and

manufacture, and is normally available for delivery in 1 - 2 months.

Works in gold, tin, copper, pyrites, uranium, diamonds. Used by Mount Isa Mines Ltd., Renong Tin Dredging Co., Hongkong Tin Ltd., Sungei Besi Mines Ltd., Aokam Tin Ltd., American Smelting and Refinery Co., Outokumpu Oy., Titania A/S, Portuguese American Tin Co.

Sigmund Pumps Ltd.

Type WA-N vertical glandless acid pumps. For installations in wet sumps, enclosed vessels or tanks, for handling acids and chemicals. Hydraulic unit arranged for submerging into liquid to avoid priming difficulties. Capacity 30 - 1,500 g.p.m. at 20 - 115 ft. head.

Also B-N stainless steel chemical pumps.

R. O. Stokes & Co. Ltd.

Pumps of frequent application in the control of thickener discharges. Two diaphragms share the pumping effort and enable a thick pulp to be handled without trouble and with good life to the wearing parts.

The ¾ in. bore pump is the smallest of a range of machines, specially designed for giving the most flexible operation to any plant pumping operation where a sandy suspension has to be handled.

ROASTING AND CALCINING

Huntington, Heberlein and Co. Ltd.

Multihearth roasting furnaces from 3 ft. dia. by 3 ft. hearth to 21 ft. 6 in. dia. by 11 ft. hearth. Used principally for desulphurizing mineral concentrates, particular examples: roasting iron pyrites in sulphuric acid production, roasting sulphur of molybdenum, copper, nickel, etc. Also used in roasting reduction of manganese dioxide. On market 60 years of originally American design, the HERRESHOFF furnace is manufactured in Britain but is obtainable also in United States. Delivery time ranges from 4 - 8 months and prices, according to size, vary f.o.b. British ports from £1,000-£30,000.

James Howden and Co. Ltd.

Sinter fans used to induce the draught required for the preparation of iron sinter used to charge blast furnaces.

These fans are of very large size and are capable of handling up to 650,000 c.f.m. of gas at 300 deg. F. and 30 in. w.g. requiring about 3,700 h.p. to drive them. They may be up to 160 in. in diameter running at 750 r.p.m.

SCREENING

Armstrong Whitworth (Metal Industries) Ltd.

Overstrom vibrating screens. U.S. manufacture since 1928, now all-British manufacture on world rights save the Americas and New Zealand. Used extensively in United States and New Zealand. Available for delivery in 4 - 6 weeks at approximately £300 - £1,500 f.o.b. British ports. Range covers wet and dry operation and light, medium or heavy duty. The seven sizes range from 3 ft. by 18 in. to 16 ft. by 6 ft. Equipped with one, two or three decks.

The first British-made screen is now being installed at Kirkwhelpington, working in conjunction with a large Kue-Ken crusher also manufactured by Armstrong Whitworth.

Automatic Coal Cleaning Co. Ltd.

" Universal " high-speed shaking screen. Used for general purposes i.e. handling raw coal 6 in. - 0 in., dewatering of washed coal down to .01 in., and sizing of washed coals to ¼ in. Screen bodies move oppositely at 1 in. stroke from 400 - 480 r.p.m. crankshaft.

" Super Vibro " screen for large tonnages of fine coals or slurries. Screens use strokes of up to 10 mm. with speeds of 850 r.p.m. maximum.

Machines have been proved and tested, not only in U.K. and on the Continent, but also in Australia, South Africa, India, Turkey and Eire. Although hitherto applied almost exclusively to coal cleaning, are suited to the wider field of mineral dressing.

Crushing, Screening and Engineering Ltd.

Vibratory screens in sizes varying from 3 ft. 6 ins. by 1 ft. 9 ins. to 12 ft. by 5 ft. and from single deck to three deck. On market 21 years and of British design and manufacture. Operating in various parts of the U.K. Spares and servicing available U.K.

Dorr-Oliver Co. Ltd.

D.S.M. screens.

N. Greening & Sons Ltd.

Perforated steel screens manufactured in a wide range of thicknesses from 20 s.w.g. down to 3/16 in. thick. The stepping of these plates results in easier screening, since the flow of the material is broken by reducing the blinding of the apertures. In this instance the apertures consist of tapered slots which are graded so as to be equivalent to different round hole sizes. These stepped screens may be used on shaker screens or stationary screens, either horizontal or sloping and they also screen dry or wet materials.

Stepped wedge wire. Used practically in all areas of the N.C.B. where difficulties have been encountered in the dewatering of slurry and small coal.

G. A. Harvey & Co. (London) Ltd.

Manufacturers of all types of screening surfaces.

International Combustion (Export) Ltd.

Hum-mer electric vibratory screens and Ty-rock mechanical screens. Together these two units form a comprehensive range of screening equipment, capable of handling any problems where either wet or dry screening is involved.

In Ty-rock full floating screen, moving parts float entirely on rubber, allowing screen to adjust itself to varying load conditions. Coal and coarse aggregates sizing up to 10 in. opening.

W. J. Jenkins & Co. Ltd.

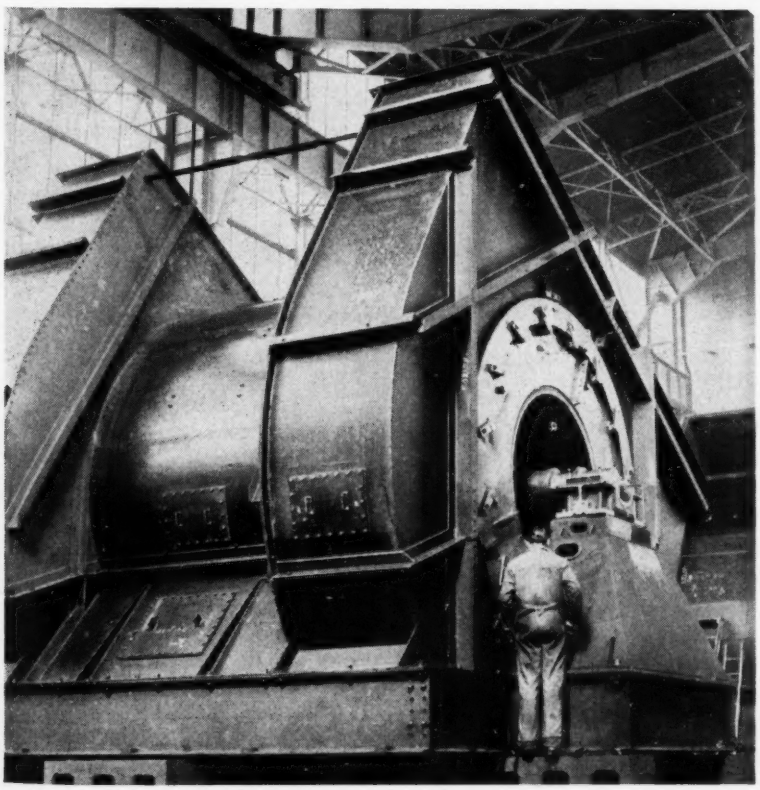
" Jenkins—S.K.B." resonance screens. Manufactured under licence from Schuchtermann and Kremer-Baum, Dortmund. Widths range from 3 ft. - 7 ft. Lengths to requirements but maximum for single unit usually approx. 20 ft. Capacities about 400 t.p.h. at max. lump size 10 in. cube. Decking and tandem operation possible. Dry or wet materials.

" Consort " reciprocating screen. Consists of two opposed screen trays on either side central crank stand. Overall length approx. 40 ft. (one screen). Can be operated in tandem. Capacities vary, i.e.: Screen width 2 ft. 4½ in.—gives up to 15 t.p.h. cone and 30 - 50 t.p.h. gravel; screen width 4 ft. 10½ in. gives 35-40 t.p.h. cone and 110 - 130 gravel.

" Viking " vibrating screens. Types are Minor (4 ft. by 2 ft. 7 in.), Major (5 ft. by 3 ft. 7 in.) and Senior (7 ft. 6 in. by 3 ft. 7 in.). In all types screening deck may be inclined 5 deg. - 30 deg. and high-speed vibrator is employed.

Also S.K.B. Baum-type jigs.

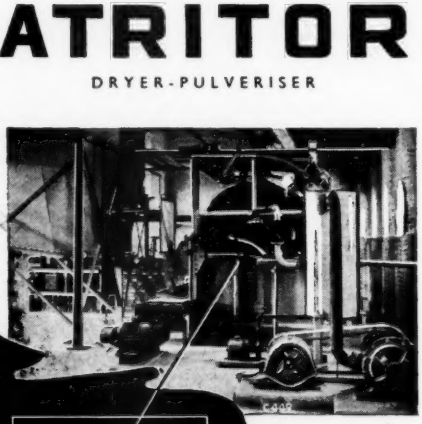
Howden sinter fan designed to handle 300,000 c.f.m. of gas at 350 deg. and 28 in. w.g. and absorbing 1,595 h.p. at 750 r.p.m. Effective diameter is 129 in.

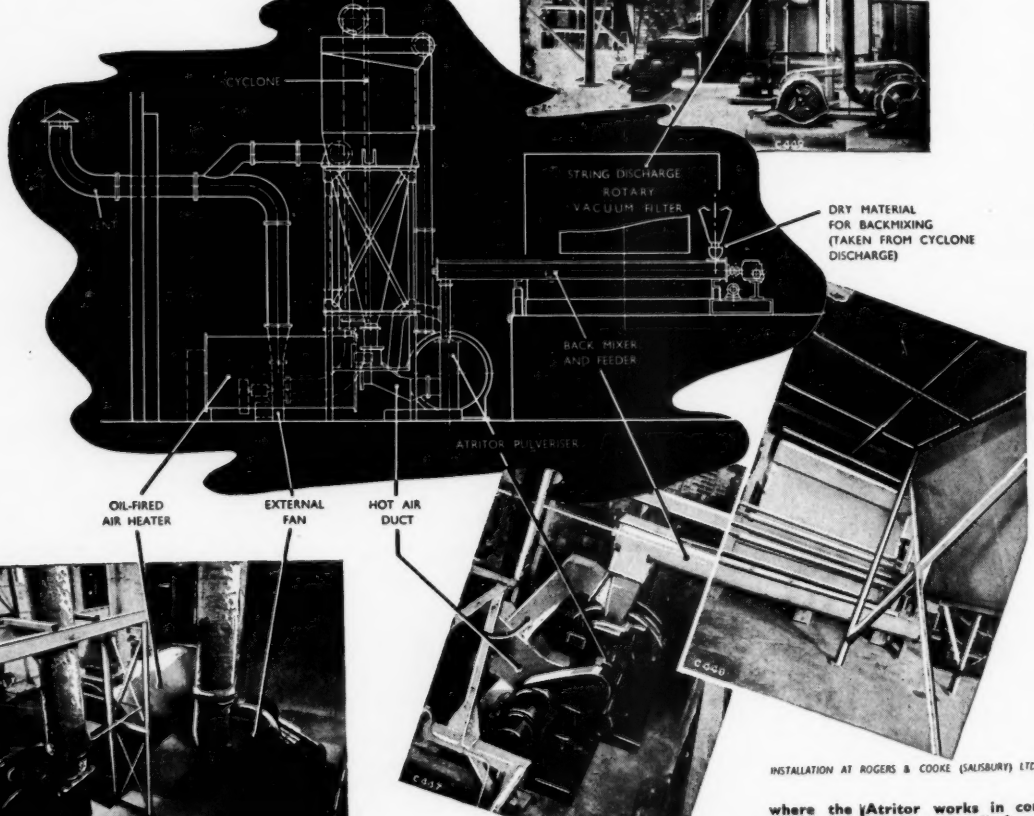


VACUUM FILTER TO FINISHED PRODUCT

ONE OPERATION
WITH THE
ATRITOR
DRYER-PULVERISER

Dries, grinds and grades without screening
Controlled or complete drying
Fineness of grinding easily varied
Requires only moderate power
Maintenance costs are low
Seven sizes with hourly outputs ranging from a few hundred pounds to twenty tons





INSTALLATION AT ROGERS & COOKE (SALISBURY) LTD

where the Atritor works in conjunction with a string discharge rotary vacuum filter for the drying and grinding of chalk

COMPLETE INSTALLATIONS SUPPLIED BY:-

ALFRED HERBERT LTD., COVENTRY

AD.272

Niagara Screens (Great Britain) Ltd.

Niagara vibratory screen range of 4 bearing type. Balanced action mechanical vibratory screen operating approx. 1,000 r.p.m. which separates by size all materials capable of being screened in the range 6 in. - 100 mesh. Capable of handling dry materials or solids in suspension. Over 50 models are available in the standard range in single to 4-deck types, size 20 in. by 40 in. to 60 in. by 160 in. Typical materials handled, abrasives, asbestos, bauxite, china clay, coal, lead, mica, tin, diamondiferous gravel, ebonite dust, fluorspar, gold, iron, pyrites, phosphates, quartz, vermiculite, zinc.

On market over 20 years, it is of British design and manufacture. Delivery 3 - 4 weeks at £250 - £1,200 f.o.b. British ports, depending on size of machine and number of decks. Annual rate of expenditure for maintenance and depreciation estimated at 10 per cent. Over 3,300 British Niagara vibratory screens already supplied throughout world. Typical user, Selection Trust Ltd. for diamondiferous gravel at Aninchehe, Tongo, Meya River. Range of applications regarded as limitless.

Also " Tenemax " tensioned piano wire surfaces for handling pit face sand and similar difficult materials on ¼ in. wide aperture. On single deck machine 4 ft. by 10 ft. type E8A, fitted with ¼ in. wide aperture high carbon steel woven wire, recovery is 35 t.p.h. Fitted with ⅛ in. wide aperture tensioned piano wire surface, recovery is 70 t.p.h.

Nordberg Manufacturing Co.

Symons rod deck screen. Incorporates an arrangement of spring steel rods in place of conventional mesh. Rods may be individually removed, turned or replaced. The machine can be supplied in sizes from 3 ft. by 6 ft. to 6 ft. by 10 ft. and requires a maximum of 10 h.p.

U.S. design and British manufacture, it has been on the market for about 20 years. Now available for delivery in aprox. 3 months at £1,000 - £2,200 f.o.b. British ports. Widely used (particularly on all types of ores in iron, gold, diamonds, tin). Spares, servicing and training facilities exist in U.K., North and South America, Australia, Africa, Scandinavia, France.

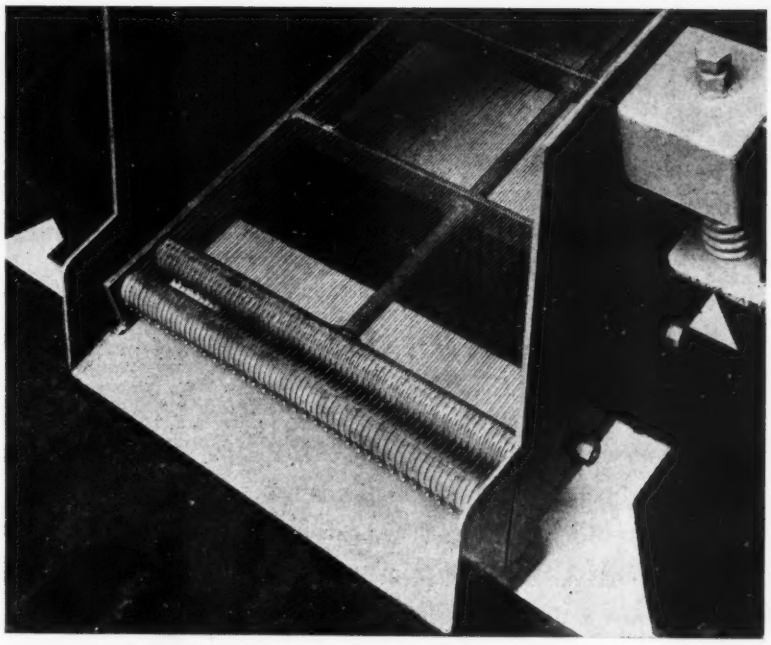
The larger machines, such as 5 ft. by 12 ft. and 6 ft. by 10 ft., have been produced recently to meet increased tonnage demands. These incorporate a heavier drive unit.

Also Symons V. screens. This screen employs a new principle, i.e. a combination of high speed gyration and drum rotation giving a greater screening efficiency and capacity. Designed for single cut wet or dry separation in the finer mesh ranges.

Again U.S. design. British manufacture. On the market about 12 years, it is available in around 3 months at £1,500 f.o.b. British ports. Used in dedusting limestone; screening asbestos, refractory materials, slag, sand, coal; dewatering coal, sand and gravel. Applications are for general screening, wet or dry, on all types of materials, and for dewatering. Spares, training and servicing facilities exist U.S., U.K. and South Africa.

Ross Engineers Ltd.

Two-roll grizzly designed for scalping ahead of primary or secondary crushers. Capable of taking a feed of largest and heaviest run-of-mine material. An important feature is ability to screen sticky material, which has made possible screening and crushing of hitherto unworkable ore and stone deposits. On market 30 years, this is of British design and manufacture. Depreciation varies with the material handled but consists mainly of hard facing the screening rolls. Used at Cockerill-Ougree (iron ore), Ocean Island (phosphate).



Discharge end of a single deck Niagara vibratory screen, 20 in. wide, equipped with a " Tenemax " surface

SORTING

Rank Cintel Ltd.

Electronic metal detector, designed to detect the presence of any metal in any non-metallic product. Mainly used for the protection of crushers from damage by metal. Size of unit depends on individual requirements, normally fits over conveyor belt with sufficient height to enable product to pass through a window aperture.

On the market 11 years, detector is of U.K. design and manufacture. Delivery approximately 2 months at about £550 f.o.b. British ports depending on aperture size. Annual cost of depreciation and maintenance estimated at around 17½ per cent.

STORAGE

Niagara Screens (Great Britain) Ltd.

Hoppers of various standard capacities. Bolted construction. Replacement parts available to template.

Structure and storage bins. Steel circular sides.

Wilkinson Rubber Linatex Ltd.

Linatex linings for mineral processing plant such as tanks and hoppers. Equipment described fully in section "Transportation".

THICKENING AND FILTRATION

Automatic Coal Cleaning Co. Ltd.

Disc filter for continuous operation particularly suited to treating coal from flotation plants and flocculated slurries.

Machines have been proved and tested, not only in U.K. and on the Continent, but also in Australia, South Africa, India, Turkey and Eire. Although hitherto applied almost exclusively to coal cleaning, are suited to the wider field of mineral dressing.

Davey, Paxman & Co. Ltd.

Filtration equipment. Rotary vacuum filters. On market over 25 years and of U.K. design and manufacture. Delivery and price are controlled by circumstances.

The equipment already giving satisfactory service in U.K. and overseas. Some in South Africa gold mines. Spares, servicing and personnel training facilities exist in U.K. only. Research and design are subject of constant attention.

Also string discharge filters. Here cake is supported on the strings, and they lift the cake off the drum at the end of the filtration cycle.

These manufacturers also make multiple disc filters, top feed filters, automatic shave-off devices when a precoating is necessary, and other additional devices.

Denver Equipment Co. Ltd.

The Denver disc filter, available from 4 ft. dia. to 9 ft. dia. by 10 disc unit. Range gives large filter area for a given floor space. Each disc provides positive gravity drainage, eliminating filtrate blowback and producing dryer filter cakes. This equipment has been on the market 15 years and is of British manufacture. Delivery can be made in approximately 3 months, entrance to no country being precluded owing to existing agreements.

Three of the largest units in the range—the 9 ft. dia. unit—have been recently installed at the new concentrating plant at St. Patrick's Copper Mines.

Dorr-Oliver Co. Ltd.

Specialists in filtration, thickening, effluent treatment.

Float-Ore Ltd.

A wide range of flocculating agents and filtration aids.

International Combustion (Export) Ltd.

Rovac rotary vacuum filters. Complete range of drum and disc types. For dewatering metallurgical pulps and coal slurries.

TRANSPORTATION

Automatic Coal Cleaning Co. Ltd.
Manufacturers of "Acco" Bloklink chain, an improved design of link assembly, for elevators composed of one long centre and two short side links in each section, and claimed to offer advantages over traditional types. Bolt passes through bucket and bush. Back and side plates of buckets pierced with elongated holes for maximum drainage; the front and bottom being solid to prevent water draining into bucket immediately below. Bucket end extends to bottom of centre link, increasing capacity.

W. J. Jenkins & Co. Ltd.
De Brouwer chain for elevators and conveyors.

Locker Industries Ltd.
Equipment for feeding materials at controlled rates from hoppers, bunkers, chutes, etc. to crushers, screens, conveyors, etc. Completely electrical in operation, no moving parts, low maintenance with feed rates controlled zero to maximum by knob. On market approximately 30 years the equipment is of British manufacture and part-British design. Prices vary according to size and specific nature of particular equipments, as do maintenance charges during operational life.
Operating at numerous properties in Africa (Union Miniere) Mary Kathleen in Australia, and at the Canadian uranium, gold and copper mines (i.e. Stanwick, Kerr Addison, East Malartic, etc.).

J. T. Meredith (Heating) Ltd.
Supply and erection of all pipework necessary for ore transportation, and water lines, together with valves, etc. Of U.K. design and manufacture, the equipment is available for delivery to suit requirements on site. Operating Esperanza Copper and Sulphur Co. Ltd., Cyprus; St. Patrick's Copper Mines Ltd., Avoca, Eire.

Neldco Processes Ltd.
Sala valve. Closes with round hole by means of pressure applied on a thick rubber insert. Valve cannot block and wear negligible. Type S on market in U.S. for 3 years. Type C available in Europe for first time. Sizes of valve range from 1½ in.-5 in.
Valve bodies are imported from Sweden, rubber inserts being made in U.K. Delivery takes about 6 weeks at about £25 for 1½ in. size. Depreciation expenditure is negligible in most cases.
Type S is widely used in U.K. by N.C.B., Glebe Mines Ltd., Capper Pass & Son Ltd. Type C extensively used Canada and U.S. Used for handling slurries or difficult liquids, larger sizes are being developed.

Niagara Screens (Great Britain) Ltd.
Elevators, bucket and belt or chain. Cone flight elevator, sand dewaterer. Bucket widths from 12 in. - 42 in. Capacities 8 - 40 yd. per hr. Horsepower required rising from 5 - 12½ through range. Note capacities based on belt speed of 45 r.p.m.
Also automatic feeders, roll, apron, reciprocating.

Ross Engineers Ltd.
Drop-bar feeder, a combined feeding and screening unit. Action of the bars permits the easy passage of fines and ensures that unblocked apertures are always presented to the feed. Layer machines will handle material up to 5 ft. cube at 2,000 t.p.h. On market 40 years. Of U.K. design and manufacture. A typical recent installation has handled over 20,000,000 tons of run-of-mine iron ore in 5 years with routine greasing and maintenance.
Currently giving service for Beauharnois Power Co., (river boulder clay), Llandulas Quarries (limestone), Ocean Island (phosphate), Guest Keen Iron and Steel Co. (iron ore), and St. Patrick's Copper Mines (copper).
Also the patent Chain Feeder. This on market over 30 years. Of U.K. design and manufacture, maintenance costs are reported as low. The equipment handles every known granular material, i.e. I.C.I., Billingham (anhydrite), A.P.C.M. Hope Quarry (limestone), Mufulira Mines (copper), New Consolidated Gold Fields (gold, etc.), Mount Isa (copper-lead-zinc ore), Appleby-Frodingham Steel Co. (iron ore), Sydvaranger (taconite).

Saunders Valve Co. Ltd.
Diaphragm valves in cast iron, malleable and non-ferrous metals, screwed and flanged from ¼ in. to 14 in. for the control of air, water and an infinite variety of chemicals. On the market 25 years and of British design and manufacture. The valves, available from stock, operate at South African gold mines, and at coal properties in Britain, Germany, Belgium and elsewhere.
These valves obtainable throughout free world either from Saunders distributors or licensees.

Wilkinson Rubber Linatex Ltd.
Linatex linings for mineral processing plant such as tanks, hoppers, chutes, launders and cones. Prepared specially for application and/or corrosion.
On market 35 years, equipment is of British design but is manufactured in Malaya. It is normally available for delivery in weeks.
Used in gold, tin, copper, pyrites, uranium, diamonds. Companies include Consolidated African Selection Trust, Ariston Gold Mines Ltd., Amalgamated Tin Mines of Nigeria Ltd., Tennessee Copper Co., Lake Shore Mines, Hellenic Mining Co. Ltd., Dome Mines Ltd. (South Porcupine Mines), New Consolidated Gold Fields Ltd., Renong Tin Dredging Co. Ltd., Kiruna Mines.
Each Linatex organization is responsible for its own territorial arrangements, and spares, servicing and personnel training facilities exist in Europe, Southern Africa, U.S., Canada, Australia and Malaya.

WASHING

Davison & Co. (Hexham) Ltd.
Logwasher. Paddle type driven by electric motor. A 25 t.p.h. logwasher is approximately 4 ft. 6 in. square by 30 ft. long. On market 30 years, of British design and manufacture, it is available for delivery in 4 - 6 months at an approximate budget price of £2,250 f.o.b. British ports. Depreciation reported as nil; replacement of blades costs £20 p.a. depending on abrasiveness of material handled.
Unit working with fluorspar for The United Steel Companies Ltd. and with dolomite for The Steetley Organization. Precluded from no countries by licensing or other sales agreements.

W. J. Jenkins and Co. Ltd.
Jenkins—S.K.B. "Teska" dense medium washer. Manufactured under licence from Schuchtermann and Kremer-Baum, Dortmund. Many sizes in range. Maximum float throughput 110 t.p.h. to 350 t.p.h.
The success enjoyed by the S.K.B. drum washer has led to the development of a new type of separator incorporating the static end weirs which are extended to form troughs and retaining a narrower form of the rotating drum which now functions as a shale extractor only.

Niagara Screens (Great Britain) Ltd.
Washers (uni-flow and contra-flow). All welded construction. Sizes from 3 ft. dia. by 10 ft. long to 7 ft. 6 in. dia. to 18 ft. long. Related capacities 10 yd. per hr. to 85 yd. per hr. Water needed is 350 - 450 g.p.yd. and horsepower 5 - 30.

WET SEPARATION

Davies Magnet Works Ltd.
"Premier" No. 1 concentrating table. Deck area 6 ft. x 3 ft. High speed headstock using cam and roller action. Complete with water pipes, collecting launders for concentrate, middling and tailing products. Including direct mounted V-belt motor drive. Weight 476 lb.
Of British design and manufacture, is available for delivery 16 - 18 weeks at approximately £275 f.o.b. U.K. ports.

Davison & Co. (Hexham) Ltd.
Hartz-type centre pen discharge 4-compartment jig. Power required 5 h.p. Will handle approx. 1 ton. Often used without ragging. On market 10 years, of British design and manufacture, it is available for delivery in 3 months at £900 f.o.b. British ports. Annual rate for depreciation and maintenance about £50.
Handles fluorspar for The United Steel Companies Ltd. and Hopton Mining Co., witherite and barytes for Settlingstones Mines Ltd., and galena for Weardale Lead Co. Ltd.

Denver Equipment Co. Ltd.
The Denver selective jig and the Denver improved Hartz-type jig. The former developed for treating—5/16 in. unclassified material using a rotating valve arrangement which admits water on the suction stroke, thus reducing the suction effect. The Hartz type is suited for handling coarser feeds from 1½ in. down to ¼ in.
On the market 20 years, it is manufactured in Britain. Most sizes of selective jigs are available ex-stock, while Hartz types can be delivered in 8 - 10 weeks.

Horace Greaves & Co. Ltd.
Automatic coal washing jig, 60 t.p.h. Weight about 25 tons, 20 ft. long, 12 ft. wide with elevator extensions. Treats coal below 150 mm. size. On market 50 years, of British design and manufacture, it is made to order in 6 months at approximately £10,000 f.o.b. British ports. Unit has useful life of 20 - 25 years, probable maintenance cost 7½ per cent p.a., covering spares, repairs, labour to install same, lubricants, but not including operating costs.
Operating principally for N.C.B., particularly N.W. Division, No. 2 Area, N.E. Division, No. 7 Area, East Midlands Division, Nos. 3, 4, 6 and 7 Areas.

Holman Bros. Ltd.
Concentrating tables. Gravity wet concentrating tables for sands and slimes. Weight, including vibrators and motion head, sand 2,286 lb., slime 2,345 lb. Overall dimensions, sand 15 ft. long, 5 ft. 4 in. wide; slime 15 ft. 3 in. long, 6 ft. wide. Motivation by electric drive. V-belt or flat belt from shafting. On market more than 50 years, but improved in this period. Holmans have been sole manufacturers since tables first marketed, except to U.S., Canada, Mexico. Wholly manufactured in Britain.
These tables are in continual production at a budget price of approximately £520 f.o.b. London. Depreciation and maintenance costs depend on type of ore being treated, its crystalography and the climatic conditions. Life could be 12 months to 12 years for the deck.

BUYERS' GUIDE

SORTING

PICKING TABLES
Davison and Co. (Hexham) Ltd.
General Electric Co. Ltd. of England, The
Head Wrightson Stockton Forge Ltd.
Hudswell, Clarke and Co. Ltd.
Nortons-Tividale Ltd.
Plowright Brothers Ltd.
Unifloc Ltd.

PICKING BELTS
Crushing, Screening and Engineering Ltd.
Davison and Co. (Hexham) Ltd.
General Electric Co. Ltd. of England, The
Head Wrightson Stockton Forge Ltd.
Hudswell, Clarke and Co. Ltd.
Niagara Screens (Great Britain) Ltd.
Nortons-Tividale Ltd.
Plowright Brothers Ltd.
Spencer (Melksham) Ltd.
Unifloc Ltd.

DETECTORS—
—Fluorescent Lamps
General Electric Co. Ltd. of England, The
—Magnets
General Electric Co. Ltd. of England, The
Rapid Magnetic Ltd.
—Metal Detectors
Rank Cintel Ltd.
Rapid Magnetic Ltd.

WASHING

SCREENS
Armstrong Whitworth (Metal Industries) Ltd.
Babbitless Co. (Great Britain) Ltd.
Crushing, Screening and Engineering Ltd.
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
Fairleede Engineering Ltd.
General Electric Co. Ltd. of England, The
International Combustion (Export) Ltd.
Niagara Screens (Great Britain) Ltd.
Nordberg Manufacturing Co.
Pegson Ltd.
Plowright Brothers Ltd.
Ross Engineers Ltd.
Saunders Valve Co. Ltd.
Sinex Engineering Co. Ltd.
Unifloc Ltd.

DRUMS AND TROMMELS
Cort, Robert, and Son Ltd.
Crushing, Screening and Engineering Ltd.
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
Fairleede Engineering Ltd.
General Electric Co. Ltd. of England, The
Head Wrightson Stockton Forge Ltd.
Knapp and Bates Ltd.
Niagara Screens (Great Britain) Ltd.
Nortons-Tividale Ltd.
Pegson Ltd.
Plowright Brothers Ltd.
Saunders Valve Co. Ltd.
Unifloc Ltd.

LOG WASHERS
Davison and Co. (Hexham) Ltd.
General Electric Co. Ltd. of England, The
Head Wrightson Stockton Forge Ltd.
Plowright Brothers Ltd.
Saunders Valve Co. Ltd.

COMMINUTION

PRIMARY CRUSHERS—
—Jaw
Allen, Edgar, and Co. Ltd.
Armstrong Whitworth (Metal Industries) Ltd.
Babbitless Co. (Great Britain) Ltd.
Boulton, William, Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Joy-Sullivan Ltd.
Moxey Ltd.
Pegson Ltd.
Sheepbridge Equipment Ltd.
—Gyratory
Babbitless Co. (Great Britain) Ltd.
Boulton, William, Ltd.
General Electric Co. Ltd. of England, The
Nordberg Manufacturing Co.
Pegson Ltd.
Sheepbridge Equipment Ltd.
—Heavy Duty Roll
Allen, Edgar, & Co. Ltd.
Babbitless Co. (Great Britain) Ltd.
Boulton, William, Ltd.
British Jeffrey-Diamond Ltd.
Crushing, Screening and Engineering Ltd.
Davison and Co. (Hexham) Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Sheepbridge Equipment Ltd.

SECONDARY CRUSHERS—
—Jaw
Allen, Edgar, & Co. Ltd.
Armstrong Whitworth (Metal Industries) Ltd.
Boulton, William, Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Pegson Ltd.
—Gyratory
Armstrong Whitworth (Metal Industries) Ltd.
Babbitless Co. (Great Britain) Ltd.
Boulton, William, Ltd.
General Electric Co. Ltd. of England, The
Joy-Sullivan Ltd.
Nordberg Manufacturing Co.
Pegson Ltd.
Sheepbridge Equipment Ltd.
—Roll
Allen, Edgar, & Co. Ltd.
Babbitless Co. (Great Britain) Ltd.
British Jeffrey-Diamond Ltd.
Crushing, Screening and Engineering Ltd.
Davison and Co. (Hexham) Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Pegson Ltd.
Sturtevant Engineering Co. Ltd.
—Hammer Mills
Allen, Edgar, & Co. Ltd.
Babbitless Co. (Great Britain) Ltd.
British Jeffrey-Diamond Ltd.
General Electric Co. Ltd. of England, The
Patent Lightning Crusher Co. Ltd., The
Pegson Ltd.
Sheepbridge Equipment Ltd.
Sturtevant Engineering Co. Ltd.

STAMP MILLS
Head Wrightson Stockton Forge Ltd.

FINE GRINDING MILLS—
—Ball
Allen, Edgar, & Co. Ltd.
Babbitless Co. (Great Britain) Ltd.
Boulton, William, Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Head Wrightson Stockton Forge Ltd.
International Combustion (Export) Ltd.
Joy-Sullivan Ltd.
Knapp and Bates Ltd.
Mitchell Engineering Ltd.
Nordberg Manufacturing Co.
Pegson Ltd.
Sheepbridge Equipment Ltd.
Sturtevant Engineering Co. Ltd.
Wilfley Mining Machinery Co. Ltd., The
Wilkinson Rubber Linatex Ltd.
—Rod
Allen, Edgar, & Co. Ltd.
Babbitless Co. (Great Britain) Ltd.
Boulton, William, Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Head Wrightson Stockton Forge Ltd.
International Combustion (Export) Ltd.
Knapp and Bates Ltd.
Nordberg Manufacturing Co.
Pegson Ltd.
Sheepbridge Equipment Ltd.
—Pebble
Boulton, William, Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Head Wrightson Stockton Forge Ltd.
International Combustion (Export) Ltd.
Knapp and Bates Ltd.
Nordberg Manufacturing Co.
Pegson Ltd.
Wilkinson Rubber Linatex Ltd.
—Atrition
Herbert, Alfred, Ltd.

ANCILLARY EQUIPMENT
Babbitless Co. (Great Britain) Ltd.
Brindley, F. J., and Sons Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Herbert, Alfred, Ltd.
Knapp and Bates Ltd.
Mitchell Engineering Ltd.
Patent Lightning Crusher Co. Ltd., The

SCREENING

GRIZZLIES
Armstrong Whitworth (Metal Industries) Ltd.
Crushing, Screening and Engineering Ltd.
Davison and Co. (Hexham) Ltd.
General Electric Co. Ltd. of England, The
Hadfields Ltd.
Head Wrightson Stockton Forge Ltd.
Nordberg Manufacturing Co.
Richards Structural Steel Co. Ltd.
Ross Engineers Ltd.
Unifloc Ltd.

ROTARY SCREENS (TROMMELS)
Allen, Edgar, & Co. Ltd.
Davison & Co. (Hexham) Ltd.
Fairleede Engineering Ltd.
General Electric Co. Ltd. of England, The
Nortons-Tividale Ltd.
Plowright Brothers Ltd.
Richards Structural Steel Co. Ltd.
Ross Engineers Ltd.
Spencer (Melksham) Ltd.
Unifloc Ltd.

SHAKING AND VIBRATING SCREENS—
—Flat
Allis-Chalmers (G.B.) Ltd.
Automatic Coal Cleaning Co. Ltd.
Cort, Robert, and Son Ltd.
General Electric Co. Ltd. of England, The
Greaves, Horace, and Co. Ltd.
Hudswell, Clarke and Co. Ltd.
International Combustion (Export) Ltd.
Jenkins, W. J., and Co. Ltd.
Locker Industries Ltd.
Nordberg Manufacturing Co.
Nortons-Tividale Ltd.
Plowright Brothers Ltd.
Sinex Engineering Co. Ltd.
Spencer (Melksham) Ltd.
Unifloc Ltd.
—Inclined
Allen, Edgar, & Co. Ltd.
Allis-Chalmers (G.B.) Ltd.
Armstrong Whitworth (Metal Industries) Ltd.
Automatic Coal Cleaning Co. Ltd.
Babbitless Co. (Great Britain) Ltd.
Cort, Robert, and Son Ltd.
Crushing, Screening and Engineering Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Greaves, Horace, and Co. Ltd.
Hadfields Ltd.
Hudswell, Clarke and Co. Ltd.
International Combustion (Export) Ltd.
Jenkins, W. J., and Co. Ltd.
Locker Industries Ltd.
Moxey Ltd.
Niagara Screens (Great Britain) Ltd.
Nordberg Manufacturing Co.
Nortons-Tividale Ltd.
Pegson Ltd.
Plowright Brothers Ltd.
Sinex Engineering Co. Ltd.
Spencer (Melksham) Ltd.
Unifloc Ltd.
—Resonance
Allen, Edgar, & Co. Ltd.
Cort, Robert and Son Ltd.
Jenkins, W. J., and Co. Ltd.
Locker Industries Ltd.
Nortons-Tividale Ltd.
Pegson Ltd.

CENTRIFUGAL SCREENS
Birtley Engineering Ltd.

REPLACEMENT SCREENS
Greening, N., and Sons Ltd.
Harvey, G. A., and Co. (London) Ltd.
Locker Industries Ltd.

WOVEN WIRE CLOTH
Greening, N., and Sons Ltd.
Potter, F. W., and Soar Ltd.
Locker Industries Ltd.

CLASSIFYING

HYDRAULIC CLASSIFIERS AND ELUTRIATORS
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
Eimco (Great Britain) Ltd.
Saunders Valve Co. Ltd.
Stokes, R. O. and Co. Ltd.
Unifloc Ltd.
Vickerys Ltd.

SPIRAL CLASSIFIERS
Denver Equipment Co. Ltd.
Head Wrightson Stockton Forge Ltd.

BOWL CLASSIFIERS
Denver Equipment Co. Ltd.
Dorr-Oliver Co. Ltd.
Stokes, R. O. and Co. Ltd.

RAKE CLASSIFIERS
Coppee Co. (G.B.) Ltd., The
Denver Equipment Co. Ltd.
Dorr-Oliver Co. Ltd.
Eimco (Great Britain) Ltd.
Stokes, R. O. and Co. Ltd.

CENTRIFUGAL CLASSIFIERS
Denver Equipment Co. Ltd.
Dorr-Oliver Co. Ltd.
International Combustion (Export) Ltd.
Sharples Centrifuges Ltd.
Vickerys Ltd.

DRY SEPARATION

SEPARATORS—
—Magnetic
Davies Magnet Works Ltd.
General Electric Co. Ltd. of England, The
Herbert, Alfred, Ltd.
Huntington, Heberlein & Co. Ltd.
Rapid Magnetic Ltd.
Unifloc Ltd.
—Electrostatic
General Electric Co. Ltd. of England, The
Sturtevant Engineering Co. Ltd.

PNEUMATIC TABLES AND JIGS
Birtley Engineering Ltd.
Knapp and Bates Ltd.

HEAVY MEDIA SEPARATION

DRUMS
Birtley Engineering Ltd.
General Electric Co. Ltd. of England, The
Jenkins, W. J., and Co. Ltd.
Neldco Processes Ltd.
Plowright Brothers Ltd.
Rapid Magnetic Ltd.

CYCLONES
General Electric Co. Ltd. of England, The
Hudswell, Clarke and Co. Ltd.
Liquid-Solid Separations Ltd.
Neldco Processes Ltd.
Sturtevant Engineering Co. Ltd.
Vickerys Ltd.
Wilkinson Rubber Linatex Ltd.
CONES, TANKS
Fairleede Engineering Ltd.
General Electric Co. Ltd. of England, The
Huntington, Heberlein & Co. Ltd.
Mitchell Engineering Ltd.
Neldco Processes Ltd.
Pegson Ltd.
Plowright Brothers Ltd.
Saunders Valve Co. Ltd.
Unifloc Ltd.
OTHER BATHS
Automatic Coal Cleaning Co.
Birtley Engineering Ltd.
Nortons-Tividale Ltd.
Plowright Brothers Ltd.
Saunders Valve Co. Ltd.
Unifloc Ltd.

WET SEPARATION

JIGS—
—General
Automatic Coal Cleaning Co.
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
Dorr-Oliver Co. Ltd.
General Electric Co. Ltd. of England, The
Knapp and Bates Ltd.
Nortons-Tividale Ltd.
Pegson Ltd.
Plowright Brothers Ltd.
Richards Structural Steel Co. Ltd.
Stokes, R. O. and Co. Ltd.
—Moving Sieve
Greaves, Horace, and Co. Ltd.
—Baum Type
Jenkins, W. J., and Co. Ltd.
TABLES
Davies Magnet Works Ltd.
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Holman Brothers Ltd.
Plowright Brothers Ltd.
Wilfley Mining Machinery Co. Ltd. The

FLOTATION

FLOTATION MA CHINES—
—Pneumatic
Birtley Engineering Ltd.
Denver Equipment Co. Ltd.
International Combustion (Export) Ltd.
Knapp and Bates Ltd.
Mechandling Ltd.
—Mechanical
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
International Combustion (Export) Ltd.
Knapp and Bates Ltd.
Mechandling Ltd.
Plowright Brothers Ltd.
—Table
Holman Brothers Ltd.
CONDITIONERS
Birtley Engineering Ltd.
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
General Electric Co. Ltd. of England, The
Knapp and Bates Ltd.
Plowright Brothers Ltd.
Unifloc Ltd.
REAGENT FEEDERS
Automatic Coal Cleaning Co.
Birtley Engineering Ltd.
Davison and Co. (Hexham) Ltd.
Denver Equipment Co. Ltd.
Float-Ore Ltd.
General Electric Co. Ltd. of England, The
Knapp and Bates Ltd.
Plowright Brothers Ltd.
Unifloc Ltd.
TABLE FLOTATION AND AGGLOMERATION EQUIPMENT
Plowright Brothers Ltd.
FROTHERS
Cyanamid of Great Britain Ltd.
Float-Ore Ltd.
Plowright Brothers Ltd.
Unifloc Ltd.
COLLECTORS
Armour Hess Chemicals Ltd.
Birtley Engineering Ltd.
Cyanamid of Great Britain Ltd.
Float-Ore Ltd.
Imperial Chemical Industries Ltd.
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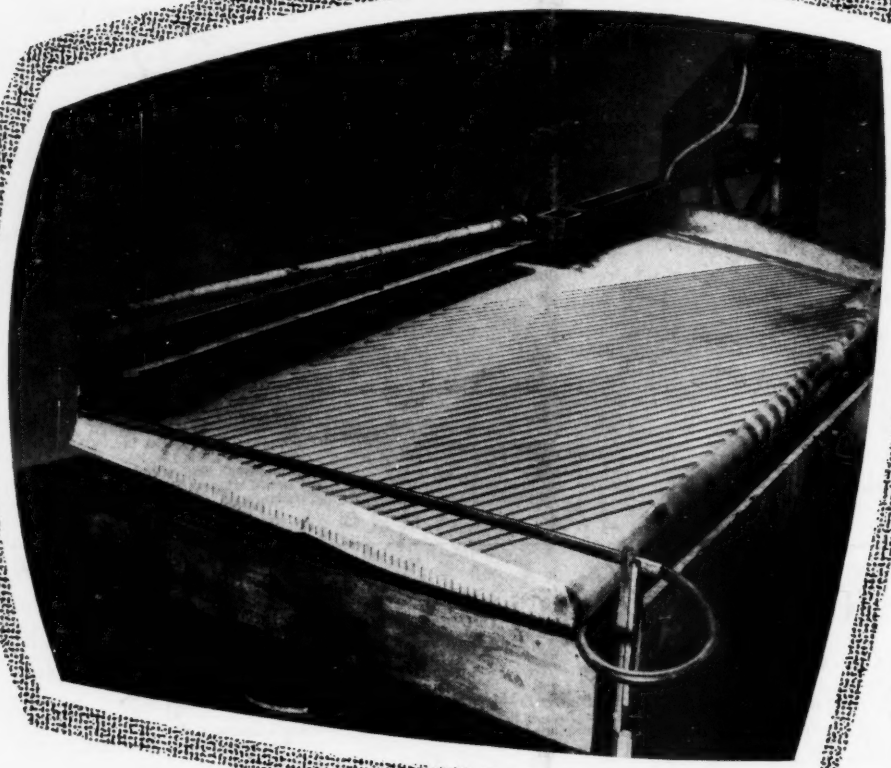

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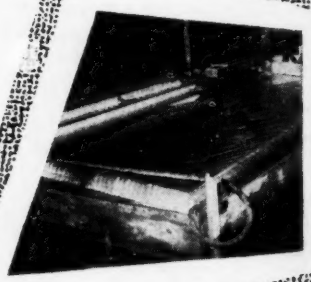

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